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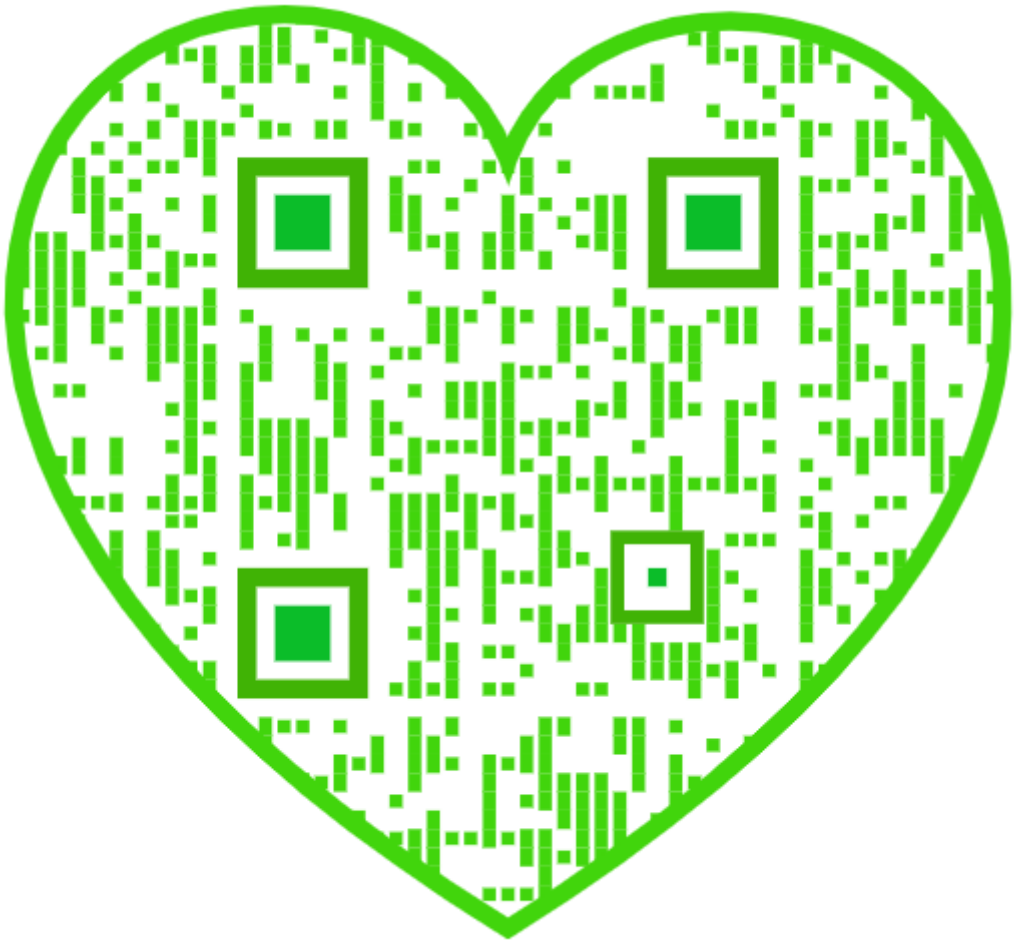

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LECTURES ON

MILITARY SANITATION

AND MANAGEMENT
OF THE

SANITARY SERVICE

U. S. ARMY SERVICE SCHOOLS

FIELD SERVICE AND CORRESPONDENCE SCHOOL
FOR MEDICAL OFFICERS

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Lecture I

MILITARY HYGIENE

HYGIENE is the science which deals with the preservation of the health. Its existence depends on past scientific discoveries. Sanitation is the method which is adopted to carry out the principles of hygiene. Sanitary methods may differ, but yet be effective, in the same way that many problems in geometry may be solved by different methods. Sanitation, therefore, is the application of scientific discoveries to prevent disease. "Military sanitation" should be used instead of the words "military hygiene" as hygiene covers all principles to insure health and application of these principles in the military service is the method of dealing with men living under conditions somewhat foreign to those that civilziation has caused to exist.

A medical officer has many duties to perform. There is hardly anything pertaining to a soldier that he is not in some way required to make recommendations or act on his own initiative, but his principal duty in time of war is to initiate the proper sanitary measures, and without your intelligent help as officers he will not be entirely successful. The greatest achievements towards military efficiency in our army, so far, have been accomplished by the medical corps by scientific discoveries and their application, and the officer who is now in command of men, and who does not give this subject the proper attention must necessarily be a failure.

In all the wars that history records (possibly with the exceptions of the Russo-Japanese war, and

the present disturbance abroad) much more disability and many more deaths have resulted from disease than from wounds. The failures of armies on account of preventable diseases are not few. Arnold in 1775 was unsuccessful because small-pox and dysentery incapacitated the command. In 1802, 15,000 of Napoleon's army perished in Santo Domingo of yellow fever and other preventable tropical diseases. The British in the Crimea lost twenty-five times more men from disease than from wounds. In the Spanish-American war there were seven times more deaths from sickness than was caused by the enemy. During the Balkan wars cholera in the Bulgarian army, and typhus fever in Servia during the present war greatly influenced the results of the attack in the former, and the defense of the latter.

The Selection of Recruits

It is quite evident to you, as common sense teaches, that it is desirable to have men accepted in the Army who are the best physical specimens, and also men somewhat intelligent and mentally alert. In a small army when men desire to enlist in great numbers this selection can be made; but there are so many men who have slight imperfections that this degree of perfection will never be reached when a great number of men are called out for active service.

At the present time War Department Orders prescribe certain requirements regarding height, weight, chest measurements, age, hearing and vision for recruits, and no departure can be made from these requirments without special authority from The Adjutant General of the Army. Past experience has shown that it is not desirable to accept men who are outside of the limits set forth in the rules

for the examination of recruits. Besides good physique, the soldier should be of good character and habits, mentally alert, with fair education and of normal temperament.

In time of peace, heretofore, the number of men rejected for enlistment were three or four to one accepted.

During the recent mustering into the United States service of the National Guard (militia) great pressure was brought to bear on the War Department to accept officers, especially, who had been rejected physically. An attempt was made to maintain the standard of the regular army in regard to the National Guard, but it was found to be impossible, yet most of the physically unfit were eliminated. During war, and the longer that war continues, the physical standard must necessarily be lowered, in order to obtain men.

System of Examination.—Up to 1907 the physical examinations were made largely by civilian physicians, employed under contract, at recruiting station in cities. Under this system great losses of men occurred as a result of disabilities discovered after the recruit had been sworn in. At the same time the government spent much money for the transportation and clothing of these defectives, while company commanders became dissatisfied on account of the poor quality of the material sent them. As a result of these undesirable features a system has been developed whereby line officers make a careful preliminary examination at their recruiting stations, and forward likely candidates to depots. At the latter points army medical efficers examine these candidates, weed out the defective ones, and enlist those qualified. The Surgeon General reports that "the present recruiting system operates in a

highly satisfactory manner and furnishes to the army recruits of far better quality than when they were examined under the former system."

Principal Defects.—The physical deficiencies which cause the greatest number of rejections for our army are: venereal diseases, heart abnormalities, defective vision or hearing, foot deformities, and poor physique. While it is not to be expected that line officers on recruiting duty shall be able to detect obscure affections of the internal organs, there are many grosser defects which are readily apparent to them. Such are: deformities, skin eruptions, pallor, emaciation, inebriety, venereal disease, defective development of parts, lice, dirty person, rupture, piles, stiff joints, varicose veins, flat feet, indecent tattooing, etc. Furthermore, internal disease may be suspected from shortness of breath, a thumping heart, dimness of vision, or irregular pulse following moderate exertion.

Character.—The character of the applicant should be determined as accurately as possible. He may satisfy all the physical requirements, but when the recruiting officer asks himself the question: "Would I be willing to have this man in my company?" there is often a decided negative. And this test is a useful one to apply with respect to the intelligence of the applicant, his knowledge of English, and his general appearance. The moral qualifications may be guessed from his features and gaze (open, frank or averted), his manner (direct or furtive and hang-dog), his person and clothing (clean or dirty). He may present the well-known appearance of a drunkard or tramp. Drug habits may be indicated by numerous marks of the hypodermic needle or very contracted pupils. A marked disproportion of features or limbs may be indications

of degeneracy, or his body may be much tatooed, some of the subjects being of an obscene or otherwise offensive nature.

Mental and Nervous Condition.—The mental and nervous condition is important. A nervous shifty, or excitable manner; wandering attention; defective memory; inability to give prompt or direct replies to questions; sudden, jerky movements, will frequently indicate an unstable nervous system or defective mentality.

Age.—Youth is a serious physical defect. We sometimes read the erroneous statement that the Civil War was fought by boys, but in that war, as in all those of history, undeveloped, immature youths succumbed to the fatigues and privations of campaign in vastly greater proportion than grown men. Prior to the age of twenty-one the bones are not fully formed, the muscles lack endurance, and the heart is unduly susceptible to overstrain. On the other hand, men over thirty, unless they have led an active, alert life, are apt to be muscle-bound and mentally slow. The limits of age for our service are, in time of peace, eighteen to thirty-five. It is therefore, to be seen that minors may be legally acceted in spite of the knowledge that great commanders have, for centuries past, protested against the recruitment of boys for their armies. From a physiologic standpoint the truly desirable minimum is not less than twenty years.

Height, Weight, Chest.—In the absence of actual diseased conditions, the physical attributes which chiefly determine the acceptance or rejection of an applicant for enlistment are the height, the weight, and the chest measurements. In normal individuals these bear a fairly definite relation to each other, which relation is set down in official tables.

Men whose chest circumference, at rest, is below 32 inches, should not be accepted, for such a chest has not sufficient air capacity. The present minimum of height is 5 feet 1 inch. The question of height is not quite so important now as in the days of shock action. Other things being relatively equal, the smaller man is generally quicker in his movements and has more endurance. In these days of specialism we might well accept vigorous men who are a little shorter that the present requirement for special service, thus releasing others of standard height for the fighting line. With respect to weight, men of the "wiry" type may be accepted when they are but a few pounds under the standard, but the mistake must not be made of confusing these with cases of defective or arrested development. In these latter, deficiency in weight, pallor, flabby muscles, a flat chest, sloping shoulders, and generally poor physique denote a feeble constitution.

Records.—It is essential, for the protection of the government, that careful records be made: (a) of all departures from the normal, including minor ones which are not considered disqualifying, and (b) of means of identification. The first is needed as a defense against unjust claims for pension. The second leads to the detection of criminals, deserters, bounty jumpers, and dishonorably discharged men who enlist fraudulently.

Depots.—Owing to the widespread derivation of recruits, depots for their collection and training are frequently afflicted with one or more kinds of contagious diseases, brought by some who have contracted them elsewhere. It has sometimes happened that measles, mumps, or some other communicable disease has developed in parties of men sent from depots, during the trip or shortly after arrival at

their destination. Army posts have thus been frequently infected, while the health of the traveling public has been endangered. If, therefore, such a disease exists at depots, the men who have been exposed to contagion should be isolated, in separate squads, until the period of incubation of that particular disease is past. If a case develops in any one squad, none but members of that squad have been exposed to it and the others may safely be forwarded. A similar procedure is advisable in camps.

Vaccination.—One of the first requirements after the enlistment of a man is to have him vaccinated against smallpox and typhoid fever. This is a very important procedure, looking to his future health and that of the army.

Personal Hygiene

Nature and Importance.—Personal hygiene means preservation of health by attention to the care of the body. It is obvious that such care is essential to keep the physical character of the soldier up to the proper standard. Napoleon is reported to have said: "The most important quality of the soldier is his ability to support fatigue and privation; physical courage is only second." Whether or not this be true, it must be apparent to any thinking individual that personal merits, including courage, are of little avail to the military man if he has not bodily vigor.

Formation of Correct Habits.—Military efficiency in an individual, then, rests upon certain considerations, chief among which are health, strength, and activity. To secure and keep these qualities it is essential for every man to form such habits as experience has shown to benecessary. These habits are: personal cleanliness; regulation of diet; avoid-

ance of execesses (particularly in eating, drinking, and sexual matters); wearing suitable clothing; keeping the bodily processes at work (kidneys, bowels, skin); taking sufficient exercise, preferably in the open air; devoting a proper part of each day to rest of the body and mind, with recreation for the latter; maintaining the surroundings in which one lives, in a cleanly state.

Personal Cleanliness.—The maintenance of personal cleanliness is even more necessary in the military service than in civil life. This is due in part to the violent exercises required of the soldier, with the resultant dirt and sweat, but especially because so many live together within a small space.

Baths and Bathing.—The most important requirement to insure cleanliness is bathing. Baths are necessary partly to rid the skin of external impurities, but chiefly to keep open the pores, which are the mouths of the sweat-glands, whose product carries away large amounts of waste and poisonous matters from the blood. Each man has a preference for a certain temperature of the water in which he takes his bath; this varies from freezing to hot. A cold bath is stimulating and is to be preferred for a vigorous man, provided he "reacts" well and feels a glow on emerging from the bath and rubbing down. The cold bath is not suited to elderly men nor to those whose circulation is poor. The proper time for cold bathing is on arising in the morning, not at bedtime, as sometimes indulged in.

It is worthy of mention that the practice of cold bathing often breaks up the habit of "taking cold," to which certain people are liable.

Hot and warm baths are soothing and best remove surface dirt; they are grateful means of re-

ducing muscular soreness after exertion, and will often induce sleep in a restless, wakeful person.

The most desirable means of bathing is perhaps in a tub in which the whole body may be immersed; in default of this and particularly in barracks, the shower-bath is very satisfactory. If means for complete bathing are not available, careful attention should, in any event, be given to the daily cleansing of the armpits, crotch and feet, as well as the hands and face. The hands should be washed after defecation and urination, lest they convey disease germs. The nails must be well kept and clean. On the march, if no water is available, a vigorous "dry rub" with a coarse towel will be found refreshing as well as cleansing. The scalp should be washed at least once or twice a month and should be stimulated daily by brisk rubbing with a brush or the fingers.

Care of the Teeth.—Every man should own a good tooth brush and use it with a tooth powder or mild antiseptic (listerine for instance) at least twice a day. If no tooth powder is available, wood ashes or wood charcoal make efficient substitutes.

Clothing.—Since clothing (especially the underwear) when soiled with sweat and dust is irritating to the skin and gives off disagreeable odors, it is necessary to keep this as clean as the body. The soldier cannot keep his person clean if his garments are filthy. Therefore, whenever possible, the soiled clothing should be washed (and with soap if it can be had). If the articles are of wool, they should be washed in tepid water and dried without wringing. On the march a man should have two suits of underclothes to wear on alternate days, thus ensuring cleanliness if the garments are regularly washed. If, at the end of the day's march, water is not available

for this purpose, the garments should be dried, then beaten or well rubbed, and hung up in the air.

Skin Diseases.—In campaign, skin diseases due to animal parasites especially lice and the itch mite usually make their appearance and cause much disgust and discomfort. They must be watched for and report of their presence promptly made to the medical officer.

Diet.—In the soldier's life the diet is, of course, regulated as far as possible by the authorities, who design and issue the ration and train the cooks by whom the articles composing it are prepared. In campaign, military considerations may necessitate cutting away from the base of supply, so that soldiers are obliged to live on the resources of the country in which they are operating or even to subsist for a few days upon the emergency ration. Every soldier should be required to learn how to prepare his individual field ration, since the necessity for this frequently occurs in field service.

The character of the food taken should vary in accordance with the coonditions of bodily vigor, occupation, climate, and food values. A vigorous man, doing heavy work, requires more nourishment than one of delicate physique following a sedentary pursuit. Climate is an important factor. Men serving in Alaska need a large amount of fats to serve as fuel in maintenance of the temperature balance. Those on duty in the Philippines require a large proportion of sugars and starches.

Dietary Don'ts.—A few general dietary principles follow, which may perhaps best be expressed in the form of prohibitions:

Don't eat hurriedly.

Don't swallow a morsel till it is thoroughly broken up and mixed with the saliva by chewing.

Don't overload your stomach, but get up from the table feeling that you could eat a little more with relish.

Don't eat unripe or overripe fruit.

Don't eat anything, while away from camp or barracks, whose materials or mode of preparation may seem questionable.

Don't bring worry or a "grouch" to the table with you.

Excess in Eating.—Overeating gives rise to biliousness and other forms of dyspepsia and overloads the body tissues with waste matters. These wastes are irritant substances and are just as likely as alcohol to cause kidney disease, gout, obesity, and hardening of the arteries. Beefy, overfed men are especially liable to apoplexy.

Excess in drinking means, to us all, overuse of drinks containing alcohol in some form. You will learn that the great majority of violations of discipline, trials by courts-martial, and subsequent punishment in our army result from this particular excess. Habitual indulgence in alcohol brings, as certain rewards, a host of physical and mental ailments. Besides weakening men physically, alcohol tampers with their will power and makes them less trustworthy even when sober.

Sexual Indulgence.—It is the popular idea that a young man must exercise the sexual function to some extent in order that he may retain his vigor. This belief is not founded on fact, for the sexual act is not necessary to preserve the health or powers of a man. Not only is this true, but it is equally true that sexual indulgence by young unmarried men is responsible for an immense amount of disease and suffering. This disease and suffering is borne not only by the men themselves, but, in a large propor-

tion of cases, by the innocent women whom they afterward marry and by their children. The wives may be, and often are, infected years after an apparent cure has resulted and the children are born diseased.

Clothing.—The prime purpose for which clothing is worn (other than that of decency) is to afford protection to the body against extremes of cold and heat. The materials used should, therefore, be such as to conserve the natural warmth of the body or to allow it to escape freely, in accordance with weather conditions. Clothing should not be permitted to interfere with the circulation of the blood, nor with the normal movements of the body.

Excretory Function.—Our bodies, in the work their various parts must perform, manufacture certain waste products which we call excretions. Now it is evident that if we do not get rid of these substances, they will clog up the body or even act as poisons. Nature has, therefore, designed certain avenues of escape for these excretions, and the chief of these are the skin, the kidneys, the bowels, and the lungs. The importance of the skin has already been dwelt upon. The kidneys can best be kept in good condition by drinking plenty of water (at least 6 or 8 glasses a day), which flushes these organs and dilutes the solid impurities of the urine. Constipation induces a variety of uncomfortable conditions, among which piles, headache, the state often called "biliousness," and mental depression are frequent. Therefore, remember to keep your bowels open.

Lungs.—The lungs are an important avenue of escape for certain waste products, chief of which is carbon dioxide. The ventilation of living rooms thus becomes desirable to dilute or cary off these

wastes, to renew that most vital element, oxygen, and to prevent overheating, and undue moisture of the atmosphere, which latter are important factors tending to the diminution of vitality. The germs of diseases which affect the respiratory tract are thrown off into the air and are likely to be breathed by healthy individuals, who are thus in turn infected. "Colds" result more often from overheated, poorly ventilated rooms than as the result of drafts and chilling. Such colds are often contagious. The transmission of tuberculosis and such acute infectious diseases as measles, scarlet fever, influenza, and whooping cough is favored by poor ventilation.

Exercise.—A sufficient amount of exercise to maintain health is ordinarily provided by military drills and other duties requiring active movement. Nevertheless, the physical condition is further improved, muscular size and strength greatly increased, and the mental outlook rendered more cheerful by athletic exercises, whether in the open air or the gymnasium. A proper appreciation of the benefits of physical exercise may be gained by a mental comparison between the rugged condition of a man who exercises regularly, and the poorly developed muscles and sallow skin of another who has some occupation which keeps him indoors at work of a light sort. The improvement is brought about by the increased activity not merely of the muscles, but of every part of the body, including the heart, lungs, skin, digestive apparatus, etc. Like all good things, however, exercise may be overdone; excessive rapidity or irregularity of the heart's action and labored breathing are warnings to stop and rest. Soldiers in campaign especially immature boys who are somtimes enlisted are very liable to heart strain and an "irritable" condition of that organ.

Arteries.—"A man is as old as his arteries," and some men grow old in this respect much sooner than the average, so care must be taken to suit the exercise to their condition.

The amount and kind of exercise best suited to each must be determined, as these vary widely in different individuals. There are men who require the equivalent of a brisk 15 mile daily walk to keep in a satisfactory physical state, while the ordinary occupation of others suffices to maintain them in excellent health.

Rest.—For the repair of damaged tissues and the relief of fatigue, a certain amount of rest for both mind and body is necessary. Different people vary considerably in their requirements, but it may be set down as a fair average that eight hours of sleep in each twenty-four hours are needed to keep the faculties at their best. In addition, work of any sort, physical or mental, must be intermitted by brief period of relaxation. Mental overwork is very common in these days of complex civilization, and exhaustion of the nervous system (neurasthenia) takes a long time for its recovery.

Recreation.—The risk of overtaxing the mind is greatly lessened by measures of recreation, which may take any proper form most agreeable to the individual. The cultivation of a fad is of especial value. The habit of worry, of "crossing bridges before one comes to them," must be avoided. Fits of "the blues," if yielded to, tend to increase in number and length and finally to unfit one for work. In garrison, on transports, and particularly in winter camps during war time, we must make provision for measures of recreation. These are essential to promote cheerfulness and contentment, and to lessen the tendency to abuse of alcohol and tobacco, gambling,

and perversion of the generative function. Entertainments of all sorts, but more particularly those participated in by the men themselves, competitions and contests, reading rooms, and opportunities for following and learning mechanical trades must be provided.

Cleanliness of Surroundings.—It is not sufficient merely to keep our bodies in a state of cleanliness by the measures previously outlined. We must also keep our surroundings—the house and grounds in which we live—well "policed," as the expression goes in our military service. It is self-evident that where people live—especially where many people are congregated in a small space—there much dirt will collect. This refers not so much to earthly particles as to the so-called organic materials which are derived from animal and vegetable sources. Under this head fall the body discharges, refuse from the kitchen, decaying flowers and weeds, cigar stubs, floor and stable sweepings, and the like. These must be received in vessels specially kept for them and frequently removed, or they give off foul odors, pollute the ground, attract hosts of flies, and act as breeding places for the germs of disease.

Preventable Diseases

In the first place, the fact must be recognized that there are no diseases peculiar to soldiers. There is not, by reason of their occupation or mode of life, any abnormal physical condition engendered which has not its counterpart among civilians. On the other hand, there are certain departures from a state of health to which soldiers are especially liable because of their work and environment. Newly raised troops and recruits generally have the highest

disease rates. Old soldiers are inured to service and have learned how to care for themselves.

Dependency of Soldiers.—"The men who compose an army are drawn from civil life, in which each individual has, to a greater or less extent, independent control of his time, choice of occupation, selection of food and dwelling place, and general sanitary care. After enlistment, soldiers lose most of this independence; they are housed, clothed, fed, and exercised under regulations which it is beyond their power to amend; they are moved from one point to another, differing perhaps very widely in climatic and other conditions, under orders which they may not presume to question; their hours for sleep, meals, work, and recreation are fixed for them without consultation with them or without regard to individual or communal preference." (Harrington.)

Inexperienced Soldiers.—In our military system the absolute dependence on the will or neglect of a superior is especially prone to result in disease conditions, because of the ignorance and inexperience of militia and volunteers suddenly called into active service. The officers have little or no knowledge of the care of troops, while the men exhibit a recklessness and disregard for the laws of health perculiarly national. The American volunteer, unless firmly commanded, displays the utmost indifference to the ordinary rules of decency. He deposits his excrement where he happens to be; he drinks of any liquid he encounters which may be dignified by the name of water; he throws his wastes indiscriminately upon the camp ground, heedless of the fact that putrefactive changes will shortly make them offensive; he gleefully seeks opportunities for alcoholic and sexual excesses; and, in defense of his heaven-born liberties, he often declines to mend his ways because

he enlisted to fight and not to perform menial occupations. The necessity on the part of line officers for familiarity with the preventable diseases to which the soldier is liable and with the fundamental sanitary principles necessary for their prevention thus becomes apparent.

Venereal Disease.—Of all the ills from which the soldier suffers, those consequent upon venery affect his effciency to the greatest extent. Our army is made up mainly of young, unmarried men, freed from the moral restraints of home, often without opportunity for association with decent women and susceptible to the suggestion of the vicious. There must be some outlet for their surplus energies. They visit places of amusement, many of which are maintained with the sole object of pandering to vice, where strong liquor and the advances of lewd women combine to break down such moral defenses as they may possess. Unless prevented by legal enactment the lowest kinds of "dives" cluster round the entrances to army posts. The soldier has a right to his amusements and we must strive to furnish such as will attract him more than evil resorts; to secure the passage of laws preventing the establishment of low brothels at our gates; and to build up the moral stamina of our men by education.

Statistics show that at least a third of all women who give their bodies for immoral purposes are suffering from some form of veneral disease. This includes not merely the professional prostitute, but the chorus girl, "saleslady," or mill hand, who, to satisfy her love for finery or for other reasons, may eke out a scanty income by occasional lapses from virtue. It is a medical axiom that every prostitute becomes infected with syphilis inside of two or three

years. It is, therefore, easy to see that the risks of contagion are very great.

The American people have, until recently, shunned public discussion of venereal matters through what may now seem to have been mistaken prudery. A great movement has lately been instituted, through the American Association for Sex Hygiene and allied societies, looking to the awakening of the public conscience and the moral education of the youth of the land.

Prevalence in the Army.—Venereal infections are responsible for an enormous amount of sickness in the army—vastly more than any other cause—and constitute the most important health problem with which we have to deal. There are constantly on the sick report from this cause a number of men which more than equals the strength of a regiment of infantry. Our army has the unenviable distinction of having a much greater amount of sickness of this nature than any foreign army. Moreover, since the Spanish-American War the ratio of such cases has rapidly increased, until it is now twice as much as in 1898. The situation must, therefore, be fairly faced and every effort put forth to determine the causes for the prevalence of venereal diseases and to devise measures for their prevention.

That the army has a greater percentage of such disease than has an equal number of vigorous young unmarried men drawn from like source in civil life is not believed. Such infections cause the largest proportion of rejections of applicants for enlistment. They honeycomb our social structure. In point of prevalence they vastly outnumber all other infectious diseases, both acute and chronic, combined.

Causes.—These are not far to seek. In the first place, sexual desire is implanted in man as a compelling factor for the perpetuation of the race. This desire is strong, especially when, by previous exercise of the function, the habit has been formed. Next, the demand for partners in the sexual relation has always created a supply, and prostitution is as ancient as history. Of late this supply has been elevated to the dignity (?) of a business, and a hideous traffic, with an intricate system for procuring young girls and suborning those who legally should prevent such traffic, is now strongly entrenched.

Preventive Measures.—How, then, shall we set about to minimize, as far as possible, the incidence and effects of these loathsome diseases, largely dependent, as they are, upon causes inherent in the nature of mankind? From a sanitary standpoint is is plain that we must apply the ordinary principles of sanitation. That is, we must recognize their contagious character and apply such preventive measures as are effective in other transmissible diseases. The most important measure of this character is the isolation of infected individuals until the danger of transmission is past. In the army we can and do control our infected soldiers, but the women from whom their disabilities were derived, as well as infected male civilians, are still at large to spread the contagion further. It is obvious, therefore, that, if we hope for success, sentimentalism and prudery must give way, and that diseased public women must be admitted to hospitals or otherwise placed under restraint till the infectious stage of the disease is over. For the diseased male, it should be made a crime knowingly to spread a venereal disease.

Education.—The measures above outlined do not conform with the yet uneducated public feeling that it is immoral openly to recognize diseases of this class and their chief transmitter, the prostitute. On the other hand, the measures themselves are certainly not immoral, while they are practical. On the moral side, the campaign of education already begun should be extended and a flood of light poured upon the subject, that all may clearly understand sex matters, the dangers as well as the immorality of illicit intercourse and the methods of spread of diseases transmitted thereby. With such education, the veil of ignorance, misinformation, and prudery will be lifted and the tendency to secret vices among children will be lessened. Havard says truly. "It is in the conscience of the young man that prophylaxis should begin." The knowledge of sexual matters acquired by a child is from bad sources and of a perverted kind. Such knowledge, secretly acquired and brooded over in secret, hastens the awakening of sexual feeling and leads to vice.

Action by the War Department.—Our War Department has acted with courage and vigor in attacking this problem. Orders were issued in 1912 directing procedures as follows:

I. That physical inspections of enlisted men should be made twice each month for the detection of venereal disease.

II. That any soldier who exposes himself to infection shall report for cleansing and preventive treatment immediately upon return to camp or garrison.

III. That any soldier who fails to so report, if found to be suffering from a venereal infection, shall be brought to trial by court martial for neglect of duty.

IV. That men so diseased shall be confined strictly to the limits of the post during the infectious stages of the disease.

V. That all officers serving with troops shall do their utmost to encourage healthful exercises and physical recreation and to supply opportunities for cleanly social and interesting mental occupations for the men under their command.

VI. That company and medical officers shall take advantage of favorable opportunities to point out the misery and disaster which follow upon moral uncleanliness and the fact that venereal disease is never a trivial affair.

Action by Congress.—Congress, too, has taken a decided stand, by an enactment providing that no officer or enlisted man who shall be absent from duty on account of disease resulting from his own intemperate use of drugs, or alcoholic liquors, or other misconduct, shall receive pay for the period of such absence.

It will be seen from the foregoing that the army now has an excellent plan for the discouragement of vice and the control of disease resulting therefrom. It is, however, in the highest degree desirable to keep the men away from more evil influences, and it is notorious that the saloon, prostitution, and professional gambling go hand in hand. The close relation between alcoholic excess and sexual indulgence is an interesting fact. A man's passions are inflamed by liquor, his will power and his judgment are alike weakened, and he yields to conditions which in his sober moments might be positively offensive to him.

Syphilis.—There are three kinds of venereal disease. The most serious to man is, perhaps, syphilis (sometimes called the "pox," and referred

to in the newspaper advertisements of charlatans as "blood disease"). This is due to a very active, corkscrew-shaped protozoal germ. Its first apparent result is an open sore at the point of infection. This sore, known as a hard chancre, does not appear for several weeks after exposure, but is then very resistant to treatment and remains for a month or more. The body is soon infected throughout, and symptoms of this condition appear most often in the form of skin eruptions and glandular swellings.

Syphilis is an infection of the entire system and its manifestations are practically innumerable. We may expect it to appear in any conceivable form, and where a chronic case of disease is obscure, tests often reveal its presence. Certain of these manifestations may (and do) appear many years after the disease was contracted. Among these are paresis (softening of the brain) and locomotor ataxia.

Syphilis is extremely difficult to cure, and, in a certain proportion of cases, never is cured. The new remedy—"606" or salvarsan—is still in the experimental stage, but it is at least certain that its use is not followed by permanent recovery, and that the older and more prolonged forms of treatment must still be employed. Syphilis is the disease which is so often transmitted to the children—"even unto the third and fourth generation," as the Good Book informs us—as well as to the wife. It may be transmitted to others not only by sexual contact, but also by means of articles (such as towels, eating and drinking utensils, a comrade's pipe) used in common. Cases also are frequently met which have been innocently acquired through kissing, surgical or dental operations, the ministrations of a nurse, and numerous other blameless ways.

The danger of transmission of the disease from father to child (hereditary syphilis) is very considerable. Many children are born dead; others die soon after birth; still others (who, though diseased, may survive) show characteristic deformities or unmistakable syphilitic lesions.

Marriage.—"Marriage of a syphilitic is permissible only after five years, during the last two of which he has been without symptoms and without treatment" (Keyes).

Gonorrhea, or "clap," is the result of infection with the bacterial germ known as the gonococcus, and is characterized by a profuse purulent discharge from the affected part. This is usually the canal of the penis (the urethra) in the male, although any mucous or serous membrane may be involved. Thus if, by carelessness or misfortune, a little of the pus is transferred to the eye, a most violent inflammation ensues and the sight is in grave danger of destruction. Gonorrheal rheumatism is a common and intractable affection. Heart disease is an occasional sequel.

Gonorrhea is even more frequently conveyed to the wife than syphilis, and with most serious results, as thousands of deaths and tens of thousands of chronic invalids attest; 60 to 80 per cent. of pelvic suppurations in women are due to this affection. The eyes of babies become infected during birth. It is estimated that 25 per cent. of blind people owe their infirmity to this cause.

Gonorrhea is popularly regarded as something of a joke, an affection but little more harmful than a cold in the head; but many surgeons look upon it as more serious than syphilis in its results, for the infection has a way of traveling along the various routes to the bladder, kidneys, and testicles, leaving

a man permanently injured and often greatly shortening his life. Gonorrhea is transmitted to innocent people—wife, child, comrade—with extreme ease, so, if thus affected, one cannot be too careful to make sure that none of the discharge is brought in contact with a healthy individual. Cotton or other material soiled with the discharge should be burned or otherwise safely disposed of.

Chancroid. — The third venereal disease — chancroid or soft chancre—is a contagious ulcer. It is always local, never constitutional, and has no relation to syphilis (although it is frequently necessary to wait for weeks before one can be sure it is not the latter). Its cause is a special bacillus. While it may occur elsewhere, it is practically always found about the genitals. Though less serious than the other diseases of this class, it is a painful and repulsive affection. In about one-third of the cases it is accompanied by an abcess in the groin known as a bubo.

Personal Prophylaxis. — Reference has been made ealier in this lecture to the War Department requirement that enlisted men who have exposed themselves venereal infection shall report at hospital or dispensary for cleansing and preventive treatment, but it may be said that the procedures used are very successful in the prevention of infection. Objection has been made that such prevention, by making licentiousness safe, encourages the latter. As already shown, our problem is to keep our soldiers physically fit, and purely sentimental considerations are of secondary importance. Moreover, our navy has given the system a fair trial, and finds an actual diminution in percentage of exposures as the result of the campaign of education.

In the absence of legitimate intercourse (that is, married life) nature will relieve the situation by an occasional nocturnal emission, which is in no sense harmful. The cultivation of pure thought, the avoidance of temptation, cold baths, simple, non-stimulating diet, vigorous physical exercise, and alcoholic abstinence will prove efficacious in overcoming desire.

Lecture II

MILITARY HYGIENE

Water, Food, Fly, and Carrier-Borne Diseases

Typhoid Fever

TYPHOID fever (or enteric, as the English call it) has for many years been known as "the scourge of armies." In our Civil War the Union Army had over 80,000 cases recognized as such, and there were probably as many more which, because of imperfect means of diagnosis, were thought to be malaria and other infections.

War of 1870.—The Germans, in the war with France in 1870, had over 73,000 cases and nearly 7,000 deaths, although active hostilities lasted but six months.

Boer War.—The British Army in South Africa, while fighting with the Boers, had 57,000 cases and 8,000 deaths.

War of 1898.—In our war with Spain we had 20,738 cases, with 1,580 deaths, among 108,000 men, all occurring within three and a half months; 1 man in every 6 had the disease, while this proportion was increased to 1 in 5 among those regiments which never left the United States. Typhoid fever caused nine-tenths of all deaths occurring among troops encamped in the United States in 1898.

Such instances might be multiplied indefinitely, but enough has been said to show what an immense amount of sickness and military inefficiency—to say nothing of the suffering and death of individuals, with economic loss—this dreaded disease causes.

How Spread.—Typhoid bacilli find the most favorable soil for growth and increase in the bowels of human beings; they are usually found also in the urine of infected individuals. The disease is spread, therefore, by the discharges of such individuals gaining access to the intestinal canals of others through swallowing substances contaminated with the germ. This may happen directly by contact with a diseased person or indirectly through infected water, milk, uncooked fruit and vegetables, dust, flies, soiled hands, garments, bedding, or tentage.

If we had a perfect method of disposal of these waste products of the body, it would not be long before typhoid fever would cease to appear in epidemic form, and only an occasional case would be encountered as the result of direct contact with an infected individual. But, under the imperfect sanitary conditions of modern existence, it will be a long time before this is realized, and in the meanwhile we must employ such measures as will reduce to a minimum the risks of contact with infectious material.

Army Epidemics.—Typhoid fever is more likely to become epidemic in military than in civil life because of the greater difficulty in disposing of wastes, and the close crowding and intimate contact of young men under the conditions of camp and barrack life. A man affected with typhoid may scatter the germs of the disease widely before its existence is recognized in himself, since it frequently happens that mild cases are not detected for a week or two from their onset. Moreover, 3 to 4 persons in every 100 who have recovered from attacks continue to breed the germs in their bodies and to discharge them with their excretions. We call such chronically infected individuals "carriers." Such a

man, by defecating in the nearest brush, stepping just outside his tent at night to urinate, or failing to cover his discharges in the sink (whereby flies may have access to them, to convey the filth to food in nearby kitchens a little later) may be sowing the seeds of the scourge broadcast. Each man who thus offends seems to think he is the only one who does such a trick and so it won't do any harm. Unfortunately, many of his comrades are looking at the matter from the same point of view. And flies are not necessarily the agents in this matter. Let us again assume one infected individual in camp. His habits as to cleanliness may be bad or his opportunities therefor poor. At any rate, his hands are sure to be soiled with infectious material, which he transfers to everything he touches—clothing, bedding, towel, the cigars or matches he proffers to a comrade, and even the food of others which he handles—for he may be company cook or cook's police. His saliva is infectious and he fouls the common drinking cup or a pipe which another may use. Or, again, a soldier's shoes may be soiled with the filth deposited upon the ground by a careless comrade. This material is carried about the camp and into the tents, and, since the typhoid bacillus may live for a time in the earth, a puff of wind of a friendly scuffle whirls the infected dust in the air, whence it is likely to be blown upon food and thus swallowed. By such means not one but dozens of men are infected, and with each new case the risks grow in geometric progression. In the multitude of cases during the Spanish-American War, impure water played little or no part. The three factors almost wholly responsible for these cases were uncovered excreta, flies attracted thereby, and personal contact with infected individuals.

Prevention.—Now, what is the "ounce of prevention" in this case? It consists, first, in the preliminary anti-typhoid vaccination of men believed to be susceptible; second, in a campaign of education (which must be shared by line and medical officers alike) in the facts just related; third, in the protection of the water-supply; fourth, in the systematic and thorough disposal of excreta and organic wastes generally; and fifth, in sharp punishment for violations of sanitary regulations.

Anti-typhoid Vaccination.—In anti-typhoid injections we now have a method of protection against this disease which is quite as efficacious as is vaccination against small-pox. It is well known that an attack of typhoid usually protects a man against a subsequent attack. Only 1 case in 143 has typhoid a second time, and the method of protection referred to is found to confer immunity in a similar way and, it is thought, to an equal degree

It is in our own service that the procedure has been most thoroughly tested and its value definitely proved. Vaccinations of officers and men who volunteered for the purpose were commenced in 1909. The results were so good that in 1911 the procedure was made compulsory for all under forty-five years of age who had never had the disease. The navy followed suit, and immunization of both services is now practically complete. A single instance of the value of the prophylactic measure to our service will suffice. This takes the form of a comparison between an army division in Florida during the Spanish War in 1898 and a division in Texas during the border troubles in 1911. Conditions as to strength of command, climate, season, purity of water-supply, and duration of camp were approximately equal. The disposal of wastes was much

superior in the latter camp, but the complete immunization of the Texas command by means of the anti-typhoid prophylactic constituted the conspicuous difference:

Year	Mean strength	Cases of typhoid (certain and probable)	Deaths from typhoid
1898	10,759	2,693	248
1911	12,801	2	0

Dysentery

Dysentery remains the most serious of the diseases to which our people in the Philippines are liable. Broadly speaking, dysentery is any inflammatory disease of the bowels in which blood and mucus appear in the stools. Based upon their causative factors there are two types, the one due to animal (protozoal), the other to vegetable (bacterial) parasites.

Amebic Type.—The principal form of dysentery under the first head is caused by an ameba, a minute animal consisting of a single cell. This is the type which causes most trouble in the Philippine Islands; it is also met with in our Southern States. The amebae enter the body with food or water and produce inflammations and ulcerations of the large intestine, which are sometimes complicated by abscesses of the liver. Their natural home appears to be the human intestine, and from this source they contaminate foods (especially fruits and green vegetables) and drinking water.

Bacillary Type.—The bacterial type of dysentery is caused by the bacillus dysenteriae. Bacillary dysentery can only be told from the amebic form by an expert, but for our purposes this fact is unimportant, since our preventive measures are the same for both. This type is very widely distributed over temperate as well as hot climates, and is the one

which is responsible whenever epidemic outbreaks occur in an army. The bacilli are conveyed from fecal matter to the mouth by contaminated food or drink. Flies are comman agents of transference and personal contact plays as large a part as in typhoid. As a result of their presence in the bowel and the development of poisons (toxins) resulting from their activities, ulcerations of the large intestine, hemorrhages therefrom, and great prostration result. This form is usually more active and dangerous than the amebic, being sometimes almost as rapidly fatal as cholera.

Camp Diarrheas.—Diarrheas are very common in field service and may result from a variety of causes, such as bad food, certain kinds of water, poor cooking, or abdominal chilling. There is also an epidemic form (heretofore referred to as camp diarrhea) which attacks large numbers of men at one time and is severe in character. One cause of epidemic diarrhea is the dysentery bacillus, which occasionally manifests its activities thus, but any form of diarrhea is bad, since it not only rapidly weakens a man, but, by irritating the intestines, it increases the liability to attack by the more serious affections, typhoid fever and dysentery. Under conditions of active service the importance of "carriers" of typhoid, dysentery, and epidemic diarrheas is greater than in civil life. Indeed, these probably constitute the most important of all factors.

Prevention.—Preventive measures for all forms of dysenteries and camp diarrheas are identical with those for typhoid fever save in the matter of vaccination, for which we do not as yet possess an efficient agent. The water-supply should be carefully protected from fouling; the feces of men sick with these diseases should be disinfected or other-

wise safely disposed of; the sick should be separated from the well; and all sources of irritation of the intestinal tract should be avoided.

Cholera

Cholera, whose normal home is the tropics, is by no means confined to warm climates, but is frequently brought to our own shores. Since we know its cause (the "comma" bacillus) and the fact that the measures for its control are similar to those for typhoid fever, we do not fear that it will affect a lodgment in the United States. Cholera has given us much trouble in the Philippines, but even there, where sanitary measures are carried out with greater difficulty, its invasions have been met and checked.

Flea-Borne Diseases

Plague

Plague, the "black plague" of the Middle Ages, establishes itself independently of climate wherever it finds favorable conditions. It has been demonstrated that rats are even more liable to this disease than man, and it is well established that infection is usually incurred through the bite of the rat flea, which after the death of its normal host, forsakes the latter and attacks man. Rats should, therefore, be relentlessly pursued, their haunts made inaccessible to them, and opportunities for obtaining food cut off. Cousins of the rat—such as the prairie dog of our western plains and the ground squirrel (tarbagan) of California and Manchuria—are subject to the disease and may be agents in its transmission. In some epidemics a very deadly form ("pneumonic" plague) attacks the lungs. Here the germ is transmitted by breathing and the flea is not a factor.

Louse-Borne Diseases

Typhus Fever

Typhus fever, the "febris bellica" of older writers, has been the scouge of armies. During the Crimean war it caused more deaths than all other diseases combined. All of you know what havoc it has played in Servia. The great Von der Goltz, of whom you will hear more about in the near future, recently died with typhus. As it is quite prevalent in Mexico it is of great importance for you to know that vermin transmit the disease from one person to another. The destruction of vermin will wipe out an epidemic.

Mosquito-Borne Diseases

Malaria

The malarial fevers constitute an important class of diseases. Other names by which they are known are ague; chills and fever; remittent fever; intermittent fever. The dreaded Chagres Fever of Panama is a form of pernicious malaria. There are three types of these fevers, each due to a different minute animal parasite which attacks the blood of man, but it is sufficient for our purpose here to know that all have a similar origin, namely, the bite of an infected mosquito. The method of transmission was discovered as recently as 1898 by a British Army surgeon.

Anopheles Mosquitoes.—Only one variety of mosquito (the anopheles) which, however, has rather numerous species is capable of transmitting the germs responsible for the disease. The mosquitoes may be recognized, in their adult or even larval forms, by peculiarities in their attitudes when at rest. The larvae (popularly called "wigglers") of

harmless (culex) mosquitoes lie head downward on the water in which they are developing, with only their breathing tubes in contact with the surface. Those of the anopheles lie parallel with the water's surface and just beneath it. Mosquitoes themselves, when resting, show opposite peculiarities; that is, the common forms lie parallel with the surface to which they cling, while the anopheles rest with their heads near the surface and their bodies angling away from it. Another point of difference is that the common form is humpbacked, while the anopheles is nearly straight from proboscis to tail. It is worthy of remark that only females are blood-suckers and thus transmitters of malaria. The male may readily be recognized by the feathery tuft on his head.

Mode of Transmission.—The transference of the infection from one man to another is accomplished in the following manner: A certain individual has malaria, which means that he has in his blood the germs which cause the disease. An anopheles mosquito bites him and draws into her stomach, along with the blood, a number of these germs, which undergo a peculiar form of development within her body. After this development is complete, this mosquito bites a healthy man, and, injecting a little saliva through her hollow proboscis in order to make the blood more fluid, she thus presents this second man with a number of undesirable guests in the shape of malarial parasites. These promptly attack such of the red corpuscles of his blood as are most available, and the cycle is complete. Thus, the conditions which must exist to favor the spread of malaria are: First, an infected human being; second, anopheles mosquitoes; third, healthy man; and fourth, opportunity afforded to the mos-

quitoes. The germ of the disease is a microscopic, single-celled animal (protozoon). This germ was discovered in 1880 by a French Army surgeon.

Prevention.—Preventive measures are as follows; first, precaution against mosquito bites by the use of screens for doors and windows, bars for beds, and head-nets and gloves when necessary at night; second, the killing of mosquitoes in houses by fumigation, trapping, or other means; third, the destruction of their breeding places (i.e., collections of standing water), associated with the cutting of high grass and underbrush near human habitations; and fourth, the routine administration (in malarious localities) of small doses of quinine to officers and men and attached civilians. When an individual is known to be infected, he should be screened with especial care to prevent access of mosquitoes to him. General Gorgas is of the opinion that when troops are marching through a malarious country the only practical measure for their protection is the administration of quinine. The theory of this procedure is that when the malarial parasites are introduced into the blood, they find there a substance hostile to them. He says further, that such anopheles mosquitoes as may bite soldiers in campaign, would not likely be infected unless the troops are quartered in or camped near some town. If the camp is occupied for more than a day or two the ground should, of course, be cleared and accumulations of water drained away or oiled.

Dengue

Dengue, better known as "breakbone fever," is a disease which causes much sickness among our people in the Philippines, but which, fortunately, does not terminate fatally. In common with malaria

and yellow fever, it is transmitted by the bite of a mosquito, so measures directed against this pest receive an additional argument.

Yellow Fever

Thanks to the late and deeply lamented Major Walter Reed, of our Army Medical Corps, who demostrated the fact that yellow fever is transmitted by the bite of a certain mosquito only, we have succeeded absolutely in eradicating this terrible disease from Cuba and Panama, where for centuries it had been prevalent. This has been accomplished by anti-mosquito measures alone. The insect concerned in the transmission of this disease is known as the stegomyia calopus or "tiger mosquito," the latter name resulting from its striped appearance, by which it may be recognized. It is peculiar in the fact that it bites chiefly in the afternoon. It is a house mosquito, residing in or near dwellings, and, since it finds favorable breeding conditions in water-tanks of ships, it is often carried about the world in this way. Its larva, like that of the culex, floats head downward in the water.

GENERAL DISEASES CAUSED BY INFECTION OF THE RESPIRATORY TRACT OR UPPER DIGESTIVE TRACT. INFECTION BY CONTACT WITH DISCHARGES OF CARRIERS

Tuberculosis

Tuberculosis is what is commonly known as "consumption," because of the wasting away of the body which is an invariable accompaniment. The tubercle bacillus, which is responsible for this disease, may and does attack any part of the human

body, but tuberculosis of the lungs so greatly preponderates that when we apply the term the pulmonary variety is generally meant. Though this affection may result from food (especially milk) containing the tubercle bacillus, the usual channel of infection is by way of the lungs, the germs being carried in the air. A soldier with the disease may, before the condition is suspected, infect the air of his squad room to such a degree that all other susceptible individuals therein may contract the disease.

Coughing and Spitting.—The germs are coughed up from their seat in the lungs; the spitting habit, as we know, is one deeply engrafted upon the American male; the germs resist death by drying to a remarkable degree. We are, therefore, likely to have in barracks the conditions best suited to the spread of this disease, namely, a number of susceptible individuals closely aggregated, an infected man who scatters his sputum carelessly about, and close air, breathed over and over because of the inadequate ventilation so dear to the average crowd.

Prevention.—The information just given readily suggests the means to be employed to prevent the spread of this affection, which are: first, the exercise of great care in recruiting, to exclude those in the early stages of the disease; second, the early recognition of such cases in the military service, with their removal to a special hospital; to this end, noncommissioned officers should be required promptly to report any man who has a persistent cough; third, ample air space per man in barracks; fourth, adequate ventilation must be provided for and its mechanism carefully guarded to insure its continuous operation. In this connection it is well to state that in our service the guard-house is the place most commonly infected, since it is usually overcrowded and

the men of most careless habits are apt to be immured therein.

Tonsilitis

Tonsilitis and other throat affections are very common in barracks during cold weather and frequently occur in company epidemics. When such is the case, ventilation is at fault, and it will usually be found that the men, for the sake of warmth, have stopped up the air inlets. Such throat affections are often quite severe and prostrating and may even resemble diptheria at first. They are not usually due to any one specific germ, but rather to one or more varieties of ordinarily harmless bacteria residing in the throat, which have taken on virulent properties by reason of the lowered vitality of the tissues due to bad air. The sick should be isolated promptly and the tendency on the part of fresh-air cowards to plug up ventilation shafts in cold weather must be appreciated and combated.

Influenza

Influenza, commonly known as "the grip," occurs in epidemic waves which affect the civilian population equally with the military, but as this is clearly infectious, being due to a well-known bacillus, and is transmitted chiefly if not wholly by contact with the sick, such contact should be avoided as far as possible. The influenzal bacillus prefers to attack the respiratory system, but may affect the digestive tract or the membranes surrounding the brain and spinal cord as pneumonia, meningitis, and ear suppurations are not unusual. Marked depression of spirits is a frequent accompaniment. Many people are cripples in health for years after an attack.

Colds

Though seldom serious in symptoms or results, common colds are so frequent and temporarily disabling that they deserve mention here. Many of them are undoubtedly "catching," and persons suffering from them should take pains to avoid close contact with others. A large percentage of cases is due to overcrowding and faulty ventilation in barracks. Other causes are wet feet and chilling following overheating of the body's surface.

Measles

We are apt to underrate the importance of this highly contagious disease, which, in time of war, when new levies of troops are brought together, becomes a really serious condition. City-bred recruits have usually had an attack in childhood, but those from country districts very likely have not encountered the infection. The disease is much more severe in its effects upon adults than upon children. In the Union Army during the Civil War there were 76,000 cases, with more than 5,000 deaths. Among the Confederates whole brigades were temporarily disbanded on this account in the early part of the war. No means of prevention other than isolation of the sick and their attendants are at present known. Measles is due to a virus whose exact nature is as yet unrecognized.

Mumps

Mumps is also a contagious disease, and, like measles, causes much disability among newly raised troops. It is not so serious in its results as measles, but is a painful and disabling affection, especially when, as frequently happens, it attacks the testicles.

Its ordinary characteristic is an inflammation of the salivary glands located in the neck near the angle of the jaw.

Cerebrospinal Fever

Cerebrospinal fever (meningitis) occurs with considerable frequency at recruiting depots, on transports, and in camps. Luckily, though many inhale the micrococcus which is its cause, but few are susceptible to the disease. Direct contact is responsible for the transference of the infection and "carriers" play a large part in its spread. It is a very deadly disease unless antimentingitic serum is used promptly. Early recognition of its presence in the command, rigid isolation of the sick and of such carriers as can be located, with disinfection of all discharges from their throats and noses, are the essentials in its prevention.

Scarlatina

Scarlatina (scarlet fever), though a highly contagious and dangerous disease, fortunately attacks adults but seldom, so does not need extended discussion in this treatise, but a case of sore throat, associated with a brilliant eruption on the skin, should be regarded as suspicious of this disease and immediately isolated.

Diphtheria

Diphtheria, another very contagious and serious affection, is far less feared since the discovery of its antitoxin. This substance has great value in the prevention of the disease as well as in its cure. It is given hypodermically to all persons exposed to the infection, as well as to the sick man.

Small-Pox

Small-pox, the disease most dreaded by our forefathers because of its repulsiveness, its mortality, and its disfiguring effects, has been robbed of its terrors by the wonderful protection afforded by vaccination, but if the anti-vaccinationists had their way this loathsome pest would reappear, deadly as ever, since it is kept alive in many communities by those who evade the means of prevention.

Varioloid is simply a mild attack of small-pox.

DISEASES DUE TO EXCESS OR DEFICIENCY IN FOOD PRINCIPLES

Beriberi

Beriberi is of interest and importance for the reason that it has attacked many of our Filipino scouts. No perfectly authenticated instance of its occurrence in an American soldier is on record. This does not mean that they are immune, but rather that their food contains the essential preventive substances. Rice-eating peoples are most often affected, and it has been found that some necessary food substance resident in the husk of the grain has been removed in the polishing process to which the higher grades of rice has been subjected. By substituting an "undermilled" rice for the polished varieties, this disease has been entirely controlled among the scouts, and its incidence much lessened among the Filipinos generally. This is the latest instance of the beneficent effects, upon the health of the native populations, of the occupation of tropical lands by the American Army.

Scurvy

Scurvy is a disease resulting from scant or improper diet and was formerly common among armies and navies. It is now but seldom encountered, although beleagured garrisons (as the Russians in Port Arthur) and remote detachments (as in Alaska) are sometimes affected. Its chief causative factor is the absence from the diet of organic acids contained in fresh meats and vegetables. Potatoes, onions, tomatoes (raw or canned), vinegar, the juices of rare meats, lemon and lime juice are preventive and curative.

MISCELLANEOUS

Effects of Heat

The effects of heat are frequently noted on the march in hot weather. These effects are of two kinds, notably differing in symptoms. In the severer type (heatstroke) the sick man is unconscious, his face is scarlet, his pulses throb violently, and his skin feels burning hot. In the other condition(heat exhaustion) the consciousness is retained, but the man feels exhausted, his face is pale, his heart beats feebly, and his skin is cold and clammy. Heatstroke is most apt to occur when the air is not only very warm, but is surcharged with moisture as well. Evaporation from the skin is interfered with, and as such evaporation is an important means whereby excess heat is withdrawn from the body, the temperature may rise to a dangerous degree. These heat effects can largely be avoided by timing the march, when possible, to take place during the relatively cooler parts of the day. The head covering should have a roomy air space and the crown should contain some light, moist object, as a wet sponge or handker-

chief or green leaves. Water should be sparingly drunk on the march; the man who empties his canteen between halts is most often the man who is overcome by heat.

Skin Eruptions

Skin eruptions are very common in campaign, for the reason that men cannot or do not keep their persons and clothing in a sufficiently cleanly state. The affections which occur most often are those due to the presence of small animal parasites. Of these, lice are the most objectionable. The hirsute parts of the head and body should be inspected for the eggs of these insects, which are readily seen as little masses attached to the individual hairs. When insects or their eggs are found, the man's underclothing should be boiled and the affected parts of his body shaved or freely anointed with mercurial ointment.

Hookworm Disease

Hookworm disease has recently been shown to be of great economic importance in Porto Rico and our South. Curiously enough, the animal source of this affection, though its home is the human intestine, makes its way into the body of the person attacked through the skin and not by way of the mouth. The eggs are passed out with the feces and the larvae—which constitute the infective form—hatch outside the body. The measures of prevention, therefore, consist of two things, namely, the proper disposal of excreta and the wearing of shoes.

FEET, CLOTHING AND SHOES

Blistered Feet

Large numbers of men are incapacitated—particularly at the onset of a campaign—by blistered feet. The two chief causes of blisters on the feet of the marching soldier are bad fitting shoes and uncleanliness. The feet should be kept dry if possible; shoes, when wet, wrinkle and lose their shape. To insure keeping the feet in good condition, their daily washing, after getting into camp, is absolutely necessary. If sufficient water is not at hand, wipe the feet carefully—especially between the toes—with a wet rag.

Shoes.—The shoe is, at least for the infantryman, the most important article of clothing. It is only after many years of experiment that a rational marching shoe has been developed for our service and the urgent necessity for exactness in the fitting of each soldier with these articles and for their proper care, appreciated. Company commanders are now held responsible for undue injuries to the feet of their men from ill-fitting footwear. Each man should have at least one pair, well broken in, for marching use. Men should be instructed in the care of shoes and of feet, and frequent inspections of both should be made.

Socks.—An infantry soldier should carry two or three pairs of socks, which ought to be soft, smooth, and undarned. Those worn on the day's march should be washed at the same time as the feet; clean, dry socks are then put on and the wet ones hung up to dry. In this way a clean pair may always be had. A woolen sock (light or heavy) is more comfortable when marching than a cotton one because it is softer and more yielding, while it ab-

sorbs the perspiration better. If perspiration of feet is excessive, a thin cotton sock under one of light wool does well.

Prevention of Blisters.—To prevent blisters, foot baths of strong brine or alum or alcohol, used for a week or more before the march, are of great service in hardening the skin. Many experienced soldiers of our army soap the feet before putting on their socks. In the German Army, socks (or rags, which many wear for economy's sake) are soaked in grease. An excellent powder, made up of starch, soapstone, and salicylic acid, is supplied by our medical department to sift into the socks. These measures are used to diminish the friction of the foot against the sock. The French have found that a small strap buckled about the instep, over the shoe, diminishes friction and lessens the tendency to the formation of blisters. If such form in spite of our care, they must be opened to allow the serum to escape.

Treatment.—The opening is made at the lowest point of the blister, with a clean needle, after the feet have been washed. The raised skin must not be disturbed, but is to be dressed with vaseline or other ointment and protected from pressure by adhesive plaster. Men afflicted with bunions or corns should be required to report promptly to the surgeon for appropriate treatment.

Clothing

Purposes.—Clothing protects the body against the changing conditions of the weather, such as cold, heat, wind and rain, shields in a measure from blows and bruises, and serves to adorn the person. The materials used for this purpose are derived from a variety of sources, animal and vegetable. The chief

substances taken from the animal world are wool, fur, leather, and skin; from the vegetable kingdom we obtain cotton, linen, and rubber, as well as a number of less important materials. A good material for clothing purposes must meet the following requirements:

1. It must afford proper protection against the weather.

2. It must not interfere with the natural functions of the skin.

3. It must exert no irritating effect upon the skin.

The characteristics and merits of the more important substances will be considered briefly.

Wool is undoubtedly the most valuable of these substances used by us. It has the merits (a) of being a poor heat conductor, thus retarding escape of warmth from the body and preventing the thermic rays of the sun from passing freely. Through its heat conservation it is much warmer than cotton, and when loosely woven, so that much air is entangled in the meshes of the fabric, its warmth is markedly increased. This property makes it most valuable in cold climates, and even in hot one it is not altogether undesirable. The olive drab flannel overshirt has been found to a very valuable garment in tropical field service. By day it keeps out heat and chemical rays, and by night it prevents chilling. (b) Wool is a great absorber of water, a very important quality, as evaporation from the body's surface during free perspiration is checked and the danger of chill lessened. Perspiration passes through linen and cotton freely and loss of heat is rapid. (c) It does not absorb odors readily. A disadvantage of wool is that its fibers become smaller and harder after washing, so that garments of which

it is composed undergo marked shrinking and stiffening. This tendency is minimized by washing as follows: Plunge garments, one at a time, in warm soapsuds and use gentle friction to cleanse from dirt. Remove and rinse out all soap carefully with cold water. Hang up to dry without wringing. Stretch into shape while drying if a tendency to shrink is observed.

Cotton is next to wool in value for purposes of clothing. It has these merits: (a) Good wearing qualities; (b) cheapness; (c) non-shrinkage in washing; (d) coolness. Its demerits are: (a) Rapid heat conductivity; (b) poor water absorption; (c) free absorption and release of odors.

Merino (a mixture of cotton and wool) is much used for underwear.

Linen (flax fiber) conducts heat even more rapidly than cotton and is also a poor absorbent of moisture, besides being much more expensive than cotton.

Paper.—It is useful to know that paper is of value in conserving warmth, and the Japanese have utilized it in military clothing. A paper vest affords marked protection against cold winds, while a newspaper between blankets adds much to comfort on a cold night.

Warmth and Coolness.—The warmth or coolness of clothing depends upon several factors: these are material, texture, and color. We have seen that, according to heat conductivity the materials named, in order of warmth, are wool, cotton, linen. Conversely, linen is coolest. With respect to texture, the more loosely woven the material, the warmer the garment. Thus, a cotton or linen loose mesh under shirt is much superior to one that is cloosely woven. The same effect of warmth may be produced by wear-

ing two or more thin undergarments, one over the other, the advantage resulting not so much from the increased thickness as from the layers of warm air. Color is of importance in this connection, in accordance with its relative heat-absorbing properties. Thus, white absorbs least heat; black, the most. Black clothes are, therefore, warmest; white, coolest; blue is next to black for warmth; olive drab and khaki are cooler than blue. Olive drab, being darker, is markedly warmer than khaki.

Socks are furnished in cotton and in light and heavy wool. Those of cotton are suitable for garrison wear, but not for marching. Those of light wool (which are really 50 per cent. cotton) are used by the majority of our men on field service. The heavy socks, of pure wool, are quite bulky, but are superior for marching wear, except in the rare cases in which they cause skin irritation. Wool absorbs perspiration better, stretches better, and fits more uniformly, so it is less likley to form creases and produce blisters, callouses, and corns. Socks should have a seamless foot, with reinforced toes and heels. They should fit well and have no rough thread ends. It is of interest to note that only two armies other than our own issue socks to their soldiers. These are Great Britain and Japan. The great military nations of the European continent expect their men to provide themselves somehow with these articles, which by us are deemed of such importance. From motives of economy many German soldiers wrap oil-soaked cloths about their feet in lieu of socks. A British military sanitarian (Colonel Melville) estimates the life of a sock to be only 60 to 70 road miles. This is probably a fair mileage for our light wool sock, but it is believed that the heavy woolen article will do considerably better.. Com-

fort and cleanliness as well as regulations require that socks shall be changed and washed daily on the march. It is well to remember that a piece of soft cloth a foot square (wool or part wool) will make a better foot covering than a worn out or poorly darned sock.

Shoes.—No one article of the soldier's clothing plays so large a part in his efficiency as the shoe. Although army commanders and sanitarians of the past century have emphasized the importance of good footwear, it is but very recently that the military shoe has received scientific study. The marching ability of armies is second to no other military factor, yet, while enormous percentages of troops in campaign have been incapacitated by injuries to the feet due to shoes badly made, shaped or fitted, it has but lately been realized that the conditions were preventable. A board of officers convened for the purpose by our War Department has recently (1912) rendered its report in the form of a truly admirable study of the foot and the shoe. A number of important recommendations are made in this report, among which are: (a) The adoption of shoes made on a rational last (one developed by the board); (b) careful fitting by company officers personally; (c) full series of sizes carried in stock at posts; (d) frequent inspections of feet by company and medical officers. The War Department has adopted these recommendations and has published them in the form of an order, in which occurs the following sentence: "Hereafter an undue amount of injury and disability from shoes will be regarded as evidence of inefficiency on the part of officers concerned and as cause for investigation." This places the responsibility where it belongs, and officers will do well to study most carefully the foot and its cover-

ings. This may best be done by consulting the work "The Soldier's Foot and Military Shoe," by Major Munson, Medical Corps, United States Army, president of the army shoe board above referred to. Major Munson lays down the following requirements for a good military shoe:

(a) It must be of good materials and well made.

(b) It must be fairly flexible, with pliable and porous uppers.

(c) The interior should be perfectly smooth, the heel broad and low, the sole but moderately thick.

(d) The arch should be flexible and without metal shank or other stiffening.

(e) It should have eyelets (not hooks) for fastening, and the tongue should lie smooth under the laces.

(f) The shoe should reach only a little above the ankle; it should be wide across the ball of the foot and should have a high toe cap.

(g) It must be comforable, neat looking, and light in weight.

(h) It must be easily put on and removed.

Civilian Models.—The styles of shoes purchasable in the shops are practically all defective in shape and unsuitable for marching. The "toothpick" type and even broadtoed models produce a forced outward angling at the junction of the great toe with the main portion of the foot. This shifts the axis of the foot, which normally should be directly to the front in marching. Shoes ordinarily purchased are too small for the wearer, either in length, in breadth, or in both these dimensions. It must be remembered that the soldier is obliged to carry a load of clothing and equipment amounting to at least 40 pounds. Under such a weight the foot, if unconfined, lengthens and broadens to a surprising

degree. This may amount to more than ½ an inch from heel to toe and nearly as much across the ball. It is thus evident that, to avoid injury in marching, the shoe must be roomy enough to allow all or a major part of this normal expansion.

Supervision in Fitting.—Soldiers cannot be trusted to fit themselves with marching shoes, as, through ignorance or vanity (or, perhaps, lack of proper size), tight-fitting footwear will usually be chosen or accepted. Thus the supervision of officers becomes necessary.

How to Fit Shoes.—Feet are measured and shoes fitted by company commanders in the following manner: The soldier stands with bared foot upon a small, graduated measuring board, resting his entire weight (augmented by a 40 pound burden on his back) upon that foot. The length of the expanded foot is read off from the board and the circumference around the ball is taken by means of a tape applied at the base of the toes. An approximation to the correct shoe length is then determined by adding 2 to the scale reading. For width, the table of sizes given in the annual price list of clothing, issued by the Quartermaster General, should be consulted. For example, let us assume that a foot measures 6½ on the scale and has a circumference of 9¼ at the ball. Size 8½ D is found to be the shoe which would approximate a fit; if this is not quite correct, others will be tried on until a satisfactory fit is had. With each trial the shoe should be snugly laced and the soldier will throw his augmented weight upon the shod foot. The company commander personally verifies the fit, assuring himself especially, by pressure with his hand, that not less than ⅔ inch of vacant space exists in front of the

great toe and that no undue pressure or wrinkling exists over the ball of the foot.

Breaking In.—New shoes should be adapted to the contours of the foot by gradual wear and should on no occasion be used for marching until broken in. If there is need for haste in the process, this may be accomplished by having the soldier stand in water for a few minutes until the leather is sodden. He should then walk about for an hour or so on a level surface letting the shoes dry on his feet. On removal, a little neat's-foot oil should be rubbed into the leather to prevent hardening and cracking. Shoes may be waterproofed by rubbing a considerable amount of this oil into the dry leather.

It is believed that with the adoption of the new shoe and its complete supply to the army, to the exclusion of other styles, our service will have footwear superior to that of any other nation. The average American has a foot rendered abnormal by long wear of shoes of bad shape or improper size. But, taken in conjunction with the oversight in fitting and care of the feet now rendered obligatory, we should have a minimum of foot troubles. The high boots worn by German and Russian foot troops furnish a striking contrast to our own shoes in appearance, comfort and efficiency. That men can march at all in such clumsy, mis-shapen footwear as that of the foreign nations cited is surprising. The weight of such boots is 4 pounds, which is twice that of our shoes.

Overshoes are desirable for garrison wear, but not usually practicable in field service. The "arctic" type is the only one officially supplied.

Lecture III

MILITARY HYGIENE

Camp Sanitation

Camps

THERE is no subject of more vital importance in the training of line officers than military hygiene. This applies with especial force to the military hygiene of field service. Why is this? Because when troops are in garrison, their mode of life approximates in hygienic arrangements, the life of the better class of the civil population. Their dwellings are constructed with a view to sanitary requirements. Their exercises and habits are similarly governed. Their surroundings, food supply, water supply and other necessities of life are established, regulated and constantly watched by highly specialized officers. In garrison the individual line officer must concern himself with the habits and personal hygiene of his men, and the general police of the post; but very rarely is it necessary for him to concern himself directly with the sanitary arrangements for living in an established post. Moreover in garrison, it is extremely unusual that the requirements of military necessity conflict with the prime essentials of military hygiene. The troops of garrison life are ordinarily disciplined men, who have received training in sanitary matters; whereas in field service in our military forces, a line officer of the standing army is very frequently placed in command of untrained or insufficiently trained troops, of the organized militia or volunteers. In the field,

and especially in active service the situation is completely reversed. Life in the field, especially where very large bodies of men are congregated, offers many problems in sanitary, as well as other arrangements. When white men are assembled in large communities, they are in modern life accustomed to systematic arrangements for good, and sufficient supplies of food and water; for systematic disposal of wastes, and all other sanitary appliances of like character. When men are suddenly congregated in the field, their officers at once find themselves face to face with the elementary problems of field sanitation. Very often, these sanitary problems must be solved by the line officer individually. At times, the requirements of military necessity may compel him to disregard the recommendations made to him by his sanitary officer even though he himself realizes their full significance. However, when we leave out of the question the factor of military necessity, the vital fact remains that sanitation in the field depends upon the line officer fully as much if not more than upon the medical officer. By the line officer I mean the company or detachment commander fully as much, if not more, than the regimental or division commander. This statement will admit of much explanation and may demand much evidence for substantiation, which I have not the opportunity to give here. I will merely cite the contrast between the mobilization camps of 1898 and 1916. In the former case, the line officers very frequently did not realize the importance of camp sanitation; in the latter, they were frequently as eager for sanitary conditions as the medical officers. In this connection, I will read the following extract from a press dispatch, dated San Antonio, Texas, November 28, 1916.

"As a result of the scientific methods adopted by the Medical Corps and the steps taken to insure absolute sanitation in border camps the big command of regulars and militia has set a new health record. From May 1, to October 31, there were only seventy-five deaths from disease in the force of more than 150,000 men, and of this small number only twenty-one deaths were due to infectious maladies.

"Typhoid fever was formerly the worst scourge of camp, but it has no place among the troops along the Mexican border. From May 1, to October 18, only twenty-one cases of typhoid developed and no deaths resulted from the disease. All of these cases were among the National Guard organizations, where in some instances the men were not inoculated with typhoid serum until after regiments had come to the border. There was not a single case among the 42,000 troops of the regular army engaged in patrol duty and stationed in Mexico with General Pershing's command.

"In Spanish-American war days—over a period of eight months in 1898—among 147,000 regulars and volunteers, the typhoid epidemic reached the enormous total of 21,000 cases and there were 2,192 deaths from the disease."

Why is it that administrative officers now lend a ready ear to the demands of field sanitation? This question is answered in part by the foregoing quotation. It will be emphasized by a statement of the statistics of the deaths in battle or deaths as a result of battle wounds and deaths from disease in a few modern wars.

Mexican War 1846-47

American Regulars Only

Died from sickness ..... 22 per cent.
Invalided from sickness, additional to preceding ..... 14 per cent.
Killed in battle or died from wounds .. 5 per cent.

American Civil War

Killed in battle or died from wounds 93,967
Died of disase 186,216
Thus two deaths are recorded for disease to one for battle casualty.

Crimean War 1854-56

French forces 310,000
Died from disease 70,000
Invalided 65,000
Battle deaths 7,500

Spanish-American War

Deaths from battle in all camps and fields..... 293
Deaths from disease in all camps and fields... 3,681
This is one death in battle to 12.5 from disease.

War Between China and Japan 1894-95

Japanese forces in the field 227,000
Deaths from battle 1,311
Deaths from disease 15,850
The ratio here is one to twelve.

That the Japanese were taught a lesson by this record is shown in the following war.

Russo-Japanese War 1904-05

Total estimated Japanese strength in field of operations 700,000
Deaths from battle 58,887
Deaths from disease 27,158

In the same war, Havard estimates the Russian casualties to have been approximately the following:

Deaths from battle 47,608
Deaths from disease 27,830

Thus it will be seen that even in modern wars until the last decade the deaths from sickness have totaled a larger figure than the deaths from battle. The non-effectives from sickness are an even more vital military factor in war than the deaths, because of the fact that ineffectives from sickness always number many times more than the losses by death from sickness. For it may be safely assumed that if a command has in a certain period 200 deaths from disease, its constant non-effective rate from sickness will be may times that number for the same period.

Before proceeding further, the question arises: "What are the principle camp diseases which produce the frightful mortality and morbidity of military campaigns?" The question is pertinent, because we are far better able to cope with an enemy known, than one concealed.

In the European Wars of the 18th Century and Napoleonic era, typhus fever was an ubiquitous scourge. This disease has never been absent in any of the prolonged wars of Europe so far as we have record. It will be remembered by you that this pestilence has prevailed in epidemic form on the Eastern and Serbian fronts during the present European struggle. The same disease is present in Mexico today, and must be reckoned with by any troops who wage war in the Southern Republic. Typhus fever must not be confused in your minds with typhoid fever, which it resembles in some respects. One marked difference in the two diseases, and the only one which here concerns us is the method of transmission; typhus fever being conveyed by the bites of the body louse, whereas typhoid fever as you well know is a disease ordinarily transmitted by infected water or food supplies. This

brings us to the triad of cholera, typhoid fever, dysenteries and allied camp diarrheas, which are often termed the water-borne or fly-borne diseases from the importance of these two factors in their causation. In American military campaigns these have caused the greatest number of losses from disease. Other diseases to be dreaded in military campaigns on this continent are the mosquito borne malarial fevers; yellow fever and dengue. Venereal and respiratory diseases while not especially associated with camp life in distinction from garrison life are always factors in the sick rate of armies.

We have briefly discussed the reasons for the importance of field sanitation, and have enumerated a few of the diseases which have decimated the armies of all history. Before passing on to the details of this subject I shall pause to emphasize again the important and responsible role which the line officer holds in relation to this subject. The supreme commander of the nation's armies, who would permit his subordinates to neglect field sanitation of campaigning troops could not with our present viewpoint be considered a wholly competent commander, no matter what other military qualifications he might possess. In no less degree, the efficiency of the division or regimental commander who would slight the sanitary care of his troops, would be diminished; and his chances of military success would be equally curtailed. Finally the company or detachment commander upon whom after all depends the execution of the prime requisites of sanitation, who, neglects or disregards the sanitary regimen of his command, is morally responsible for the deaths and illness from preventable diseases which occur among his men; is morally responsible to his country for the ineffec-

tives from the same sources in his command; and is directly and judicially responsible to his higher commanders for failure to enforce the well known laws of camp sanitation or to adopt the proper and practicable recommendations of his medical officers. The importance of your future position, gentlemen, as executive officers in these matters, impresses me strongly with my duty to you in this regard. Do not, as you go out in the service, think lightly of the sanitation of your command. Do not neglect it or disregard the advice of your surgeon. Do not permit petty personal or official differences to influence you in the matter of the care of your command and its protection from disease and death. Do not make the life of your sanitary inspector a burden by regarding him as an iniquitous pest when he is in fact performing his proper military duty. Finally, do not modify or shelve or otherwise fail to take proper action on his sanitary recommendations, unless you are certain that the department will approve of your action in stacking up your sanitary knowledge against that of the medical officer; or that the law of military necessity compels you to disregard his advice; or finally that his recommendations are wholly impracticable. In the last event, you may save yourself much difficulty by referring the matter to higher authority with your indorsed expression of opinion.

Camp Sites

Field Service Regulations has the following sanitary requirements for camp sites and other sanitary arrangements of camps.

Par. 236. The ground should be easily drained, naturally healthful, and large enough for depots, corrals, hospitals, etc., and the encampment of troops

without crowding, and with ample space for exercise and instruction.

The water supply should be excellent and abundant and not liable to contamination from any source.

Par. 238. **Selection of Site.**—There is often little choice in the selection of camp sites in war. Troops may have to camp many nights on objectionable ground. Nevertheless, sanitary considerations are given all the weight possible consistent with the tactical requirements.

When tactical questions are not involved, and especially when the camp is to be occupied for some time, great care is exercised in selecting the site. Through no fault of their own, troops occupying an unsanitary site may suffer greater losses than in the battles of a long campaign. A medical officer assists in the selection of camp sites.

The selection of camp sites while on the march or during active operations is governed by the following conditions:

1. The ground should accommodate the command with as little crowding as possible, be easily drained, and have no stagnant water within 300 yards.

2. The water supply should be sufficient, pure, and accessible.

3. There should be good roads to the camp and good interior communication.

4. Wood, grass, forage, and supplies must be at hand or obtainable.

Closely cropped turf with sandy or gravelly subsoil is best; high banks of rivers are suitable, provided no marshes are near.

In hot summer months, the ground selected should be high, free from underbrush, and shaded with trees if possible.

In cold weather, ground sloping to the south, with woods to break the north winds, is desirable.

Old camp grounds and the vicinity of cemeteries are undesirable. Marshy ground and stagnant water are objectionable on account of the damp atmosphere and the annoyance and infection from mosquitos. Ground near the foot of a hill range generally has a damp subsoil and remains muddy for a long time. Thick forests, dense vegetation, made ground, alluvial soil, punch-bowl depressions, inclosed ravines, and dry beds of streams are unfavorable.

Camp sites should be selected so that troops of one unit need not pass through the camp grounds of another.

As a protection against epidemics, temporary camp sites in the theatre of operations should be changed every two or three weeks.

Par. 240. **Establishing the Camp.**—Camp is established pursuant to the halt order. This order provides for the outpost, if necessary, and gives instructions for the encampment of the main body. When practicable, large commands are encamped by brigades.

The camping ground may be selected by the supreme commander, but in large commands is generally chosen by a staff officer sent forward for that purpose. This officer, with a representative from each brigade and regiment and a medical officer, precedes the command, selects the camping ground, assigns sections thereof to the larger fractions of the command, and causes them to be conducted to their respective sections on arrival. He also desig-

nates the place for obtaining drinking and cooking water, for watering animals, for bathing, and for washing clothing, in the order named, from upstream down.

On the arrival of the troops, guards are posted to enforce proper use of the water supply; the interior camp guards proceed to their places, and after posting sentinels, pitch their tents. The remaining troops pitch tents and secure animals and equipment; kitchens are established and details made to procure fuel, water, forage, etc., and to prepare latrines and kitchen pits; if necessary, tents, company streets, and picket lines are ditched.

In the presence of the enemy, places of assembly for the troops are designated and directions given for their conduct in case of attack. Lines of information are established with the outpost.

Par. 241. **Billeting.**—Unless the force is small, shelter of this character is usually inadequate, and some of the troops must use shelter tents or bivouac. Villages and large farms often afford facilities, such as wells and forage, which contribute to the comfort of the troops; it is therefore advantageous to camp or bivouac near them.

Par. 232. In enemy territory public and private buildings may be used to shelter troops and for other military purposes; but for sanitary reasons troops are seldom quartered in private buildings.

Par. 242. **Bivouacs.**—On marches or in the presence of the enemy troops are frequently forced to bivouac on account of lack of suitable ground or for tactical reasons. On the other hand, in fine weather, in midsummer, or in the dry season in the tropics, the troops may bivouac from choice.

From the tactical point of view, bivouacs are very convenient, but for sanitary reasons they are

resorted to, as a rule, only when necessary. The general principles governing the selection of camp sites apply to bivouacs. The ground should be dry and protected against sun and wind. Light woods are nearly always good sites for infantry bivouacs, on account of the shelter and material available.

Par. 244. **Shelter During Sieges.**—To guard against danger from epidemics in the necessarily crowded camps or cantonments of the besiegers, the most careful attention is paid to the water supply and sanitation.

Par. 245. **Care of Troops.**—Lack of sufficient rest renders troops unfit for hard work and diminishes their power of resisting disease. Therefore commanders should secure for the troops, whenever possible, their accustomed rest.

The rules of sanitation are enforced.

Men should not lie on camp ground. In temporary camps and in bivouac they raise their beds if suitable material, such as straw, leaves, or boughs can be obtained, or use their ponchos or slickers. In cold weather and when fuel is plentiful the ground may be warmed by fires, the men making their beds after raking away the ashes.

When troops are to remain in camp for some time all underbrush is cleared away and the camp made as comfortable as possible. Watering troughs, shelter in cold weather, and shade in hot, are provided for the animals, if practicable.

In camps of some duration guard and other routine duties follow closely the custom in garrison. The watering, feeding, and grooming of animals take place at regular hours and under the supervision of officers.

The camp is policed daily after breakfast and all refuse matter burned.

Tent walls are raised and the bedding and clothing aired daily, weather permitting.

Arms and personal equipment are kept in the tents of the men. In the cavalry, horse equipments are usually kept in the tents, but in camps of some duration they may be placed on racks outside and covered with slickers. In the artillery, horse equipments and harness are placed on the poles of the carriages and covered with paulins.

The water supply is carefully guarded. When several commands are encamped along the same stream this matter is regulated by the senior officer. If the stream is small, the water supply may be increased by building dams. Small springs may be dug out and lined with stone, brick, or empty barrels. Surface drainage is kept off by a curb of clay.

When sterilized water is not provided, or when there is doubt as to the purity of the water, it is boiled 20 minutes, then cooled and aerated.

Par. 246. "* * * * * * * * * * * * * From latrines 50 yards to nearest occupied tent; but, when a smaller camp is desired, the space between company latrines and the men's tents may be used to park carriages and animals. Latrine seats are provided at the rate of one seat to about every ten men; shower heads at one to every 50 to 100 men, depending upon water pressure."

Thus you see, the prime essentials of camp sites are definitely prescribed in this manual, which is primarily compiled for the use of combatant troops. I have quoted them in detail, because your attention is thus directed to the fact that you always have at hand a guide in these matters; and further because you cannot go far wrong in camp sanitation if you obey these simple rules. The War Depart-

ment has under date of September 11, 1916, seen fit to issue a General Order (No. 45) governing sanitary regulation of camps. This order should be in the possession of every officer. I shall quote this frequently in the subsequent discussion.

A few additional remarks will not be useless to you. Whenever you are required to select a camp site, it is important to consider the conditions in the neighborhood of the proposed camp. Other things being equal it is always better from a sanitary standpoint to place a camp away from fixed habitations such as villages or towns than in or near such places. As a general principle also it is wiser to place a camp above stream in preference to down stream from a town when the camp site is to be along a water course. If you are sent ahead of a marching command to select a site, do not regard your work as satisfactorily done until you have endeavored to ascertain some information concerning prevailing diseases among the inhabitants and domestic animals of the locality. If any one of the serious water borne diseases, typhoid, cholera, or dysentery is present; if typhus fever or other serious contagious disease is present; if a serious epidemic is present among horses or cattle; the community should be avoided even for a temporary camp site. In the instance of a temporary camp site for a small body of men, it is often sufficient when you have selected a location which appears to meet all requirements, that you cause inquiry to be made at all nearby houses, or to the village doctor or some other well informed person in the community as to the presence of contagious or communicable disease. In selecting camp sites for large bodies of men, a medical officer will assist his commander in this matter. His recommendations should in all cases be given due consideration.

The following details are to be kept in view in considering the desirability of a camp site from a hygienic viewpoint.

1. The site must be sufficiently extensive to accommodate the entire command without crowding. For a bivouac or very temporary camp, this feature is of much less moment than in camps of longer duration, because in the latter it is a well established law that the more densely men are concentrated, the more liable they are to the occurrence of communicable diseases. Havard considers that a brigade should be the maximum for one camp.

2. The site should be high enough to secure a dry camp. An especially desirable site is a plateau or ridge with a gentle slope to secure natural drainage; but a sharp slope from one camp to the next is most undesirable for the reason that the pollution of one camp drains into the next. In cold weather, a slope to the south with woods or other obstruction to protect from the winds is desirable. In summer or in tropical campaigns high grounds, breeze swept and preferably shaded by trees are more agreeable camp sites. Grounds at the foot of ravines are subject to flooding and are exceedingly unhealthful and unsatisfactory.

3. Camps should not be placed in the vicinity of marshes or stagnant waters. These favor the prevalence of mosquitos, with their attendant mosquito borne diseases as well as their constant annoyance. These localities also favor rheumatic affections, tuberculosis and many similar affections. A camp site must be dry, well cleared and well swept by the sun and prevailing breeze. A camp site which has been priorly used for the same purpose within three months should be avoided.

4. The best soil for camp sites is a gravel or sand-gravel soil which readily permits rain water to sink through it. On the contrary a clay or clayey soil is the least satisfactory. The character of he soil and subsoil has much to do with the comfort and health of a permanent camp, and when there is opportunity to choose, this factor deserves remembrance. It is quite important that the ground water should not be nearer the surface than eight feet. Twelve feet is a safer figure. A pure sand soil is disadvantageous on account of the glare; the constant blowing about of the surface sand; and the mechanical difficulties of camping in sand.

5. The presence of occasional trees and shrubs is desirable because of the protection during the heat of the day, the lessening of ground dampness, and the restful effect upon the eyes. Heavy foliage or underbrush is unhealthful and undesirable. A grass covered soil is a blessing to a camp and should be preserved as long as possible.

Water

Nothing is of greater importance in the selection of a camp site than an adequate supply of potable water.

What is an adequate supply of water? Manifestly a temporary camp does not demand the same amount as a prolonged camp with its shower baths, laundering facilities, and even disposal of sewage by a plumbing system. Again a mounted command requires a much greater supply than a dismounted one. You will find on p. 207, F.S.R. the following useful data on daily water requirements.

Water.—Approximate daily requirements:

1 gallon per man on march.
5 galons per man in camp .
6 to 10 galons per animal on march and camp.

(The above figures apply to water taken from streams, where animals are watered at the streams, and cooking water carried. In estimating the daily supply for permanent or semi-permanent camps, where water is piped to kitchens, bath houses, etc., the requirements will be 25 to 30 gallons per man and 10 to 15 gallons per animal, depending on climatic conditions.)

What is potable water? The potability of water supply should always be referred for decision to a medical officer, when present with the command. In case of doubt or suspicion as to the safety of a water supply, you are directed by F.S.R. to require that the water supply for your command be boiled for twenty minutes.

Water supplies are derived from three sources; the sky; the surface of the earth; the depths of the earth. Rain water properly collected in clean, impermeable cisterns is potable and above suspicion, but is rarely available for even a small body of troops. Surface waters from rivers, streams, lakes and ponds may be pure or contaminated according to circumstances. The chief factor in the matter is human pollution. A river or stream flowing thru a sparsely inhabited country is usually a reasonably safe water provided there is no pollution within several miles of camp. A flowing body of water is self purifying by dilution; by sedimentation; by effect of sunlight; by the activities of animal and vegetable life. Factors to be considered are size and rate of flow of stream, and amount and proximity of pollution. A river or stream even 100 miles below a large community in which a water borne disease is prevalent is an unsafe water supply. A camp site on a very large lake, many miles removed from a town usually affords a safe water supply, provided

the camp is not permitted to pollute its own water supply. Small lakes and ponds in thickly populated regions or near human dwellings are a dangerous water supply. Springs are really out-croppings of subsoil water and must be considered with reference to their source and liability to pollution. This may often be approximately determined from the surface configuration. More accurately by color or bacterial tests.

Sub-soil water supplies are generally classed for purposes of sanitarians as coming from deep or shallow wells. The distinction lies not in any mathematical terms but in the fact that deep wells pass thru one or more impermeable layers of the earth's surface, whereas shallow wells do not. As you probably know, a layer of water is encountered a few feet below the earth's surface. The depth varies greatly in different localities from a few inches to many feet. Similarly the height of this ground water varies greatly in different localities. This is called subsoil water or ground water and is the accumulated water from surface drainage of whatever description, which is thus held at this level by reason of a supporting layer of the earth's surface which is relatively or wholly impermeable. Any well which does not penetrate at least one impermeable layer must then of necessity draw upon this subsoil or ground water for supply. You will readily understand then why it is that in thickly populated communities we interdict the shallow well. You will readily see that such water supplies in thickly populated places will receive constantly pollution of every character; and even in sparsely settled places be liable to sufficient contamination to be viewed with suspicion.

That is the point I desire to emphasize. Shallow wells are always suspicious water supplies. It would be suicidal for large bodies of troops to obtain their water supply from shallow or dry wells on or very near a camp site of any but the briefest duration. Small bodies of men may use water supplies from shallow wells, when such have been carefully examined, and sources of pollution excluded. In this connection two phases of military field life must be considered. Troops permanently or semi-permanently encamped should not use shallow wells for water supplies unless these supplies are treated as suspicious water supplies and are kept under constant medical surveillance. Troops on the march or when campaigning may be obliged to use water from these sources. In such cases, how would you as an organization commander determine the probability of the purity of such wells? In the first place, you must examine the surface area drained directly by the well in question. This area is a circle whose radius is four times the depth of the well. This figure is merely approximate. Contamination from surface pollution may of course proceed a much greater distance. But in this special area no source of pollution is permissible. Such sources may be privies, cess-pools, pig-styes, manure piles, cattle sheds, stables and in fact any manifest organic pollution. When you come to examine the wells of American villages and agricultural communities by this simple test, you will be surprised to find how many of these derive their water directly from such filthy sources. The second test is the position of the well with reference to the slope of the land. Land slope may or may not indicate the current of ground water depending entirely upon the geology of the locality. On the other hand, a well dug on the

mid slope of a hill, whose summit is crowned with a privy would obviously be an unsafe water supply.

The third test for you to make is valuable in proportion to your energy in its prosecution and the intelligence and honesty of the response. Make inquiries among all households in the vicinity who are using or have used this well for a drinking supply. What illness have they had in the past two years? If typhoid, dysentery, diarrheas or other water borne diseases, this water supply is highly suspicious and must be boiled before use for drinking. I have outlined briefly the means whereby you can judge roughly of the purity of shallow well-water. Do not take upon yourself the responsibility of passing upon such supply if you have a medical officer on whom to bestow this, his proper responsibility. In the absence of a medical advisor, apply the foregoing tests, exercising such judgment as your experience formulates. In case of doubt, always order water supplies to be purified. So doing you free your conscience from the possibility of having illness or death of your men placed upon it. Deep wells penetrate at least one impermeable layer and if properly constructed are usually safe for drinking. Havard says, "A well to be above suspicion, must comply to the following requirements; it should traverse the entire aqueous stratum and extend to the subjacent impervious clay or rock; it should be lined throughout or at least above the water with a well constructed masonry wall vaulted at top with manhole in center, and thoroughly cemented inside." The safest rule in prolonged camps is to require that a competent chemical and bacteriological examination of the water supply of troops be made at frequent intervals.

Food

Army Regulations are now quite brief in prescribing the field ration as follows:

"The field ration is the ration prescribed in orders by the commander of the field forces. It consists of the reserve ration in whole or in part, supplemented by articles of food requisitioned or purchased locally, or shipped from the rear, provided such supplements or substitutes correspond generally with the component articles or substitutive equivalents of the garrison ration."

RESERVE RATION

Bacon	12 ounces
or meat, canned	16 "
Hard bread	16 "
Coffee, roasted and ground	1.12 "
Sugar	2.4 "
Salt	0.16 "

I shall not enter into an orderly discussion of the relative values of different articles of food; but confine myself to a few remarks which appear to me as practicable.

There are five essential elements in food supply as follows:

1. Proteids; examples of this class are { flesh of animals / animal products }
   Function to replace tissue loss.
2. Fats; function to produce body heat.
3. Carbohydrates; examples, sugars, starches, vegetable products.
   Function to produce energy.
4. Salts and Extractives, obtained chiefly from { fruits / vegetables / flavoring agents }
   Function—chemical and biologic adjustment.
5. Water.

All of these elements must be represented in definite ratio in a diet on which human beings are to subsist for any prolonged period. Failure to furnish the minimum required amount of any one of these elements will result in disease production.

Some ofthe great scourges of the world have resulted from disregard of this law of nature, among them scurvy; beriberi; pellagra (probably); sprue (probably); rickets. These are well recognized disease entities, in addition to which are to be remembered the countless less definite evidences of mal-nutrition seen in persons who are deprived of a balanced diet. A dietary then must not only be sufficient in amount, but characterized by sufficient variety. Of the five elements of diet which you as an organization commander must always be on your guard to remember in the company ration, No. 4, listed as salts and extractives and obtainable chiefly from fruits and green vegetables, is the one which is most frequently neglected with unfavorable results. Remember, gentlemen, that a diet containing all of these elements except element No. 4 will not be made complete for subsistence by the addition of canned foods. The reason of this is that the process of canning requires a very high degree of heat, which destroys a certain element in the food. This is called, "vitamin." Its prolonged deprivation is very probably the causative agent in three of the world's great plagues; Beri-beri, pellagra and sprue. Remember then, that a varied diet is equally as necessary as a liberal one, and that fresh or dried fruits, and green vegetables, potatoes and other articles containing the essential salts or vitamines are necessary for an adequate diet.

Concerning the amount of food necessary for the subsistence of your men, you will quickly learn when you begin to handle a company mess. Men marching or campaigning in a cold or stimulating climate may be safely given a very liberal ration. On the contrary, men in garrison or prolonged camp in a hot country will be in better health for a diet

restricted especially in meats and fats. In the former case, a wise commander will purchase with his ration allowance the greatest possible amount of real food utilizing the government straight ration; whereas in the latter he will cut down on the beef and beans and purchase more delicate and less heating foods. You will find that time devoted to the conduct of your company mess is well spent. A well-fed body of men is content, willing to work, and disinclined to indulge in drunkenness. A well-fed company becomes an organization which enlisted men desire to join and stay with. Consequently it can build up a cadre of good men. Moreover if you do not watch your mess, you will not only find discontent and disciplinary troubles, but you will find financial frauds and dishonesty sooner or later among the men to whom you leave the matter. General Orders 45, 1916, has the following on foods and drink in camps:

"Food and Drinks.—No food, drinks, or like commodities will be sold in camp except in the authorized exchanges.

Attention is called to the use of the following foods, the elimination of which from the messes will serve to prevent a variety of intestinal disorders:

(a) Canned milk and fish opened the day before. (Fish and milk poisoning.)

(b) Hashes of meats and potatoes prepared the night previous. (Ptomaine poisoning of severe type.)

(c) Locally grown green vegetables, uncooked. (Dysenteries and diarrhea.)"

The field cooking may be of any character from the individual cooking of active campaign to the comparatively elaborate methods of permanent camps. At the present time the field range is the

most usual means of field cooking. Time is lacking for details concerning field paraphernalia for cooking. A few simple rules will suffice.

1. Kitchens, messes and food-store tents must be located at opposite end of company from latrines. (F.S.R. Par. 246.)

2. Kitchens should be sheltered in marching command by tent fly and brush shelter when possible; in prolonged camp by a fly proof shack.

3. Kitchen floors should be well tamped, and sprinkled before each sweeping, and should be well ditched.

4. Kitchens and all utensils must be clean at all times. Screened kitchen shacks should have improvised fly traps.

5. All fresh food should be covered or protected from flies, dust and dirt at all times. Fresh food should be handled in a cleanly manner. This includes bread.

6. Garbage and other refuse should not be collected in or about a kitchen. Much, if not all of it, can be incinerated at once.

7. Men should not be permitted to sleep in kitchen or food-store tents, nor to eat in their sleeping quarters.

8. Ice boxes and drinking water barrels should not be sunk in the earth.

9. Tinned meats and vegetables should be rejected if perforated or bulging or otherwise evidencing contamination.

10. Not only the kitchen, food-store tent, and mess tent should always be scrupulously clean and fly free, but the earth surface around and about these places.

11. Make it clear to your mess sergeants and cooks that you will not be satisfied with anything less than absolute cleanliness in their department.

12. Enforce your views by frequent personal inspection and disciplinary measures for neglect.

Disposal of Wastes

Wastes may be classified as:

1. General refuse.
2. Human excrement.
3. Animal excrement.
4. Kitchen wastes.
5. Waste waters from kitchens, shower baths, etc.

F.S.R. provides for the disposal of general refuse as follows: "The camp is policed daily after breakfast and all refuse matter burned."

F.S.R. provides for disposal of human discharges as follows:

"Latrines for the men are always located on the opposite side of the camp from the kitchens, generally one for each company unit and one for the officers of a battalion or squadron. They are so placed that the drainage or overflow can not pollute the water supply or camp grounds.

When the camp is for one night only, straddle trenches suffice. In camp of longer duration, and when it is not possible to provide latrine boxes, as for permanent camps, deeper trenches should be dug. These may be used as straddle trenches or a seat improvised. When open trenches are used the excrement must be kept covered at all times with a layer of earth. In more permanent camps the trenches are not over 2 feet wide, 6 feet deep, and 12 feet long, and suitably screened. Seats with lids are provided and covered to the ground to keep flies from reaching the deposits; urinal troughs discharging

into the trenches are provided. Each day the latrine boxes are thoroughly cleaned, outside by scrubbing and inside by applying when necessary a coat of oil or whitewash. The pit is burned out daily with approximately one gallon of oil and fifteen pounds of straw. When filled to within two feet of the surface such latrines are discarded, filled with earth, and their position marked. All latrines and kitchen pits are filled in before the march is resumed. In permanent camps and cantonments, urine tubs may be placed in the company street at night and emptied after reveille." This paragraph briefly states the methods commonly employed in our service. G. O. 45, 1916, disposes of excreta as follows:

"Disposal of Excreta.—Where a water carriage system is not feasible, the Havard box will be used over the earth latrines. Daily inspection of this system is enjoined on the part of the medical officer of the organization, who will see that the following plan is carried out:

(a) The latrine will be burned out daily with crude oil and hay. (Each burning, one gallon crude oil and fifteen pounds of hay or straw.)

(b) The boxes will be at all times kept fly tight; this implies closure of all cracks, care of the hinges and a back construction so that the lids drop automatically. The latrine seats will be washed off twice weekly with a one one-hundredths solution of creolin, or other disinfectant, and whitewashed inside twice weekly.

(c) When filled to within two feet of the top, latrines will be filled with dirt, their position marked, and new latrines constructed.

(d) Where water carriage system is in vogue, either the automatic flush or trough system will be installed."

In the foregoing order it is customary to have a noncommissioned officer such as the noncommissioned officer in charge of quarters take a squad and carry out the burning described under (a). For the compliance with requirement (b) it is an excellent plan to require the company artificer to visit the company latrine daily and repair defects.

Animal excreta is always a difficult problem especially in a large camp. Only the highest discipline, and constant labor will dispose of the mass of manure and picket line refuse. The reason that its destruction is so imperative lies in the fact that manure is the natural breeding place for flies. It is estimated that ninety per cent. of flies breed in manure and horse droppings. The complete process requires about ten days. The fly larvæ burrow into the depths of the manure or the damp earth beneath until maturity is reached, so that an apparently harmless manure pile may harbor millions of flies. The fly you must remember is just as much to be regarded as a danger as the enemy's bullet, and may kill off your men in much greater number.

G. O. 45 directs as follows:

"Disposal of Manure and Care of Picket Lines. —All manure will be hauled to the camp dump. Picket lines will be kept broom swept, and all manure and straw hauled off daily. A weekly incineration of the picket lines will be accomplished with crude oil at the rate of 10 gallons to each line. Crude oil may be obtained from the Quartermaster Corps on usual requisition."

The foregoing paragraph merely transfers the manure and with it the responsibility for its disposition to another place, e. g. the camp dump. A camp dump must be at least one mile from camp, and in the opposite direction from prevailing winds when

there are such. At the camp dump, manure may be disposed of by burning in a huge improvised incinerator; or by spreading out in thin layers for drying. The first way requires much constant labor, some fuel and the highest discipline, especially in large commands. The second way requires labor, discipline and constant official supervision, so much so as to also prohibit complete success. Those of your number who may have ever attempted to govern fatigue parties distributing manure in a thin layer over the earth's surface will readily visualize the difficulty of so governing the same work for a division. One or the other of these ways may be successful with a small body of troops. The very best way for a large command such as a brigade of mounted troops or an infantry division is by arrangement with some commercial parties to haul away by train or otherwise the entire supply each day. If this can not be done, the best way is to have the dump at least two miles from any part of the camp. Flies rarely travel so far unless carried by high winds. Carcasses of dead animals should be carted to a spot selected by a sanitnry officer and there burned or buried. The latter is usually the more practical plan.

G. O. 45 prescribes the disposition of kitchen wastes as follows:

"Disposal of Garbage.—For detachments or companies in camps, or in isolated location where other means are not available, the incinerator will be installed.

If wood is plentiful and medium-sized stones can be obtained, both liquid and solid refuse can be disposed of by using incinerators improvised for each company as follows:

A pit is dug about five feet long, two and one half feet wide, and six inches deep at one end and 12 inches at the other; the excavated earth is banked around the pit and the latter is then filled with stones on which a fire is built; when the stones have become heated, liquid refuse is poured into the pit (shallow end), where it gradually evaporates; solid matter is burned on the fire.

The efficiency of this type of incinerator depends largely upon the fact that porous earth absorbs a very large part of the liquid slops, but is not considered practicable to destroy the usual accumulation of slops every day without using an extravagant amount of fuel.

A type of incinerator having a fire bed of rock one foot deep will not permit the heat from the fire to penetrate beyond that depth. The rock wall on three sides of the fire bed absorbs much heat that otherwise might be dissipated into space, which increases the evaporating capacity of the incinerator enormously, and requires a comparatively very small amount of fuel. Incinerators built of large rocks are considered to be most efficient.

About one sixth of a cord of wood per day per company is considered more than sufficient for the destruction of all slops and garbage if ordinary care and attention are given the incinerator. Liquid slops should be evaporated by being poured slowly along the vertical walls of the incinerator not upon the fire bed, and the solid garbage should be placed on top of the fuel. It has been determined that a skilled attendant can destroy 100 gallons of liquids and 23 cubic feet of solid garbage in about 12 hours by using one sixth of a cord of wood.

Where rock is not available, material (brick 340, lime three fourths bag) will be obtained on

requisition from the quartermaster. Where disposal in a sanitary way can be made by means of carts, the garbage can may be used. The cans will be thoroughly cleaned, scalded, and coated with crude petroleum after emptying.

Kitchens and Mess Rooms.—Kitchens and mess rooms will be securely screened and an efficient fly trap provided for catching such flies as gain entrance thereto. An effective fly trap consisting of a light wooden frame covered with wire gauze, extending to about one eighth of an inch of the floor of the trap, is readily constructed. It has been found that sweetened water slightly acidulated with vinegar is an excellent bait.

Ice boxes installed will be inspected daily and drip pans emptied and scalded out.

Garbage cans will be kept on wooden racks and elevated from the ground and cans burned out daily with oil to prevent fouling, and kept clean outside with a coat of whitewash."

There are briefly three ways of disposing of kitchen garbage, burning, carting off and burying. In a general way their relative sanitary value is as in the order named. Sometimes, two methods may be combined, thus for example: solids burned, liquids carted off or burned. The principle involved is to leave no organic refuse in or about camp to pollute water of food supplies or harbor and breed flies.

Waste waters from shower baths must be carried off by natural or improvised watercourse so as not to be a source of mosquito breeding or a nuisance to a camp.

Hygiene of the March.—A few remarks must suffice. The health as well as the comfort of marching commands is influenced by the manner in which its details are arranged. A commander should con-

sider these when military necessity does not rule otherwise. When a prolonged march extending over many days is undertaken, especially by a command not inured to marching, it is wise to begin the journey by short daily maches, gradually working the men up to longer marches. In this way, the men gradually harden up, their feet toughen and by the end of a week, they are fit for the longer hikes. He who gives very long hard marches on the first three days will not hasten the ultimate time of arrival, nor bring an equal number of fit men to the goal. This rule applies to regular troops as well as others. An average day's march for commands not greater than a brigade is for foot troops 15 miles, mounted troops 20 to 25 miles. For divisions or larger bodies the journey must be cut down 20 per cent. Troops hardened or spurred by necessity may of course cover much more territory. Remember that a command that is soft may much more readily march 20 miles on one day than 45 miles in three days, in other words the fatigue is cumulative for unseasoned men, because they do not recover from one day of fatigue when the next begins.

The time selected for marching has appreciable effect upon physical condition of men and animals. Night marches or marches beginning before daybreak depress the spirits of men and the vitality of men and animals. Especially is it hard on animals to march before they have had their food in quiet and at the customary time. In very hot places, however, marches are best conducted either in the early morning hours or late afternoon and evening. When a day's march begun in the early forenoon can not be concluded by 1:00 P. M. it is wiser to break its fatigue by a halt and light lunch shortly before noon. Similarly all-night marches should be broken about

midnight by a light meal. Customarily men march fifty minutes and rest ten in the hour, thus covering about 2½ miles each hour. A faster rate is more than proportionally wearisome. It is wise to march methodically by the watch. The leading troops march more easily than the tail of the column. Therefore in long marches, each unit should have its turn as the leading element. At the first halt on the day's march, a period of twenty minutes is usually given men to relieve themselves, readjust packs or otherwise get in marching trim.

Marching troops can eat and digest most anything, so that no especial sanitary rules apply to troops in this status. A moderate morning meal eaten leisurely at least one half an hour before taking the road is the best provision for the coming journey. The discipline of a command is well gauged by its conduct respecting water drinking on the march. It is an excellent rule for a company commander to require his men to start the day's march with a canteen filled with water, and with a clear understanding that none shall have further supply until at least one half hour after concluding the day's march. The only exception is the march in excessively hot weather when a greater water supply must be provided. This should either be transported with the command or taken from sources examined or approved by the C. O. Men should never be allowed to break ranks and forage for water except in circumstances of extraordinary necessity. This rule should be enforced for discipline and training as well as health. The cardinal rules for a snapshot judgment of water supplies have been already recited. If you have a medical officer along, put him on the trail of the water supply as soon as you near the place of noon or evening halt. If not, exercise

your own judgment, remembering the instructions in F. S. R. concerning the boiling of suspicious waters, and the protection of your water supply by guards.

The care of the feet of your men is extremely important. It should have begun long prior to a march by personal supervision of the shoeing of your men; by personal bi-monthly inspection of your men's feet; by inspection of the shoes and socks of your men before the march; and by the hardening and seasoning of your men by practice hikes. These are all prescribed by War Department orders, and if their provisions have been intelligently and faithfully executed, you will have little or no trouble on the march. But if you have neglected them, your men will suffer, and you may have the mortification of seeing your company crippled by the disability of footsore men. Higher commanders now place the blame for this condition on the unit commander. In order to lessen the woes of the footsore, require your men to start with good shoes and socks, and if allowable with a pair of gym shoes or slippers for resting the feet after the day's march. At the termination of a day's march, men should bathe their feet when practicable in cool water, dry them, and apply clean dry socks, immediately washing out the pair worn. Blisters are best treated by zinc oxide plaster or dusting with the regulation foot powder. Prevention is much simpler and more satisfactory than cure of bruised and blistered feet.

When troops are marching in an inhabited country or when travelling along routes which will be traced or retraced by themselves or their comrades, it is imperative that the road shall not be left in a polluted state. Therefore when a command reaches the place for the day's halt, the commander selects

sites for latrines, and causes there trenches to be dug at once. In a fly country a guard is placed over each straddle trench to compel men to cover their deposit with earth. Before resuming the march, the site of the bivouac is properly policed. This constitutes the "good manners" of an army.

Lecture IV

THE SANITARY SERVICE OF THE MARCH IN CAMPAIGN

IT MAY be said that the Sanitary Service of the March should begin with the physical examination of the recruit. Napoleon, the most illustrious of all eugenists, is alleged to have begun before this, when he sent recruiting sergeants, selected for their mental and physical qualities, to the villages of France, almost depopulated of fit adult males by the ravages of war. Certainly the selection, training, clothing, and equipment of the soldier must be controlled carefully, in order to permit efficiency on the march, and in combat; and this canot be too painstaking and thorough. Given the recruit of proper conformation, as shown by physical examination, he should be trained physically and mentally for the duties which will be required of him. His clothing, shoes, and equipment, must be furnished and adjusted in such a manner, as to permit freedom of movement, without constriction or interference with organic functions; and he must be instructed, and physically trained by carefully graduated exercises in use, and manner of carriage of equipment, marching, and personal and general hygiene. This training must not be excessive, as to duration in time of effort, at first, because the average American recruit has had little training in walking and weight carrying, and his physical development is not completed. Excessive drill will not only retard his set up, and development, but may possibly, give a temporary

breakdown in some part of the organs of locomotion (most frequently in the feet), and by reason of exhaustion and discomfort affect his morale as a marcher.

The sanitary service on the march in campaign, concerns itself with the institution of proper sanitary measures for the prevention of disease, the care and evacuation of the sick, and the conduct and administration of the personnel and material for these purposes on the march, in camp, and combat.

The attached sanitary troops, before beginning the march, supervise the final sanitation of the abandoned camp, bivouac, or field and arrange for the care and transportation of the sick and disabled; usually each battalion surgeon with his unit personnel, covering the command to which he is attached, under the supervision of the surgeon, who makes a final survey of the situation. The battalion sanitary personnel, consisting of a medical officer, a noncommissioned officer, and an orderly mounted, and one or more litter squads of two men each, marches at the rear of the battalion to which attached. This position places the sanitary personnel at a point where on the ordinary march it will be able to observe the general condition of the personnel of the command, and come up in the course of the march, to any fall-outs, without the necessity of special exertion on their part, or upon the part of anyone in going forward to secure their services; and permits observation of signals from the front, should service be required in this direction. This position at the rear of the battalion, leaves the personnel in position to cover, without unnecessary movement, the battalion, or any part of it, should it deploy.

The medical officer with the battalion, will not, at all times confine himself to a position at the rear of the battalion, but will, from time to time, go forward to inform himself as to changes in march conditions; the condition of various members of the command he has under observation; in response to calls for services; and to observe conditions of water or other supply on the route of march; and at halts will supervise disposal of excrement, wastes, etc. Before the noon halt, if there be such a halt intended, and before approach to camp, he should ride forward in order to inform himself as to water, drainage, terrain, etc., in order to give such assistance, from a standpoint of sanitation, as may be necessary.

Cases, sick or disabled, requiring care or treatment, are sent with a pass, showing the name, company, and regiment or corps, of the sick person, to the medical officer in the rear. The medical officer returns the pass showing the disposition of the case. The medical officer should dispose of this case according to the conditions; he may relieve him of his pack, if he be an infantryman, and require him to march, or he may put him in an ambulance or any other transportation, if there be no ambulance attached to the organization; or he may require him to march full pack, at the rear of the organization, under observation. Wherever a fall-out is separated from the organization, he is given a diagnosis tag, showing the orders given him. The arms and personal equipment of a foot soldier accompany him, the mount, saddle equipment, and saber of a mounted soldier are returned to the troop, usually by the n. c. o., who accompanies him (F. S. R. 343.)

Rapidly moving mounted commands will usually have no transportation other than mounts or gun carriages for the disabled, in which case, the squad-

ron surgeon, must act in accordance with the patient's condition, and the circumstances of the march. The patient may be required to follow the command at a walk, he may be sent back, escorted or unescorted by a sanitary soldier, with or without wheeled transportation, toward the main body, or the lines of communication or he may be left, with or without an attendant, under shelter, to be cared for by friendly inhabitants or to be picked up by sanitary troops, furnished with proper transportation.

Whatever action is taken with regard to the disposition of the disabled and their equipment, careful note and report must be made of it, in order that all may be cared and accounted for, and at the end of the march, collected, examined, treated, and, if necessary, evacuated to the rear.

Those sanitary troops attached to separate or independent battalions, will have in addition to their personal equipment, one pack mule, with aid station equipment, which will accompany the battalion combat train, of which it is a part. The sanitary troops attached to a regiment, are usually divided for march, camp, and combat duties, into the battalion or squadron, and headquarters sections, giving to the regiment of infantry, three battalion and one headquarters section.

The headquarters section usually consist of the senior medical officer, the senior n. c. o., one orderly, all mounted, and from two to four privates in numbers, and mounted or dismounted, in accordance with the allowance of men and animals for sanitary troops of the arm with which they are serving. The senior medical officer—the surgeon—with his mounted orderly, marches with the staff of the regimental commander, unless there be no other medical officer

with the regiment, then he marches in the rear. He is required to be with the regimental commander, in order that he may be available for consultation with regard to sanitary matters, and that he may be informed as to general and special situations, as they may arise, relating to various conditions that might affect sanitation and care of the troops, and the handling of the sanitary troops; the selection of camp sites, examination of water and food supplies, disposal of wastes, and dispositions of the sanitary troops.

The senior noncommissioned officer of the sanitary troops (headquarters section) with the privates of the Medical Department attached to his section, marches at the rear of the last battalion, with the sanitary troops of that battalion, and has in his charge the pack mule, carrying the regimental aid station equipment, and the ambulance, if the regiment is part of a reinforced brigade or division of which ambulance companies are a component. If the regiment is acting independently, he will be in charge of the three or four ambulances and, on arrival at camps, the wheeled transportation, which carries the regimental infirmary or hospital. The position of the headquarters section of the regimental sanitary personnel at this point on the ordinary march, permits control of equipment and transportation on the march, and in case of deployment, leaves this equipment in proper position, in readiness to advance and establish where directed. Under this condition, the wagons of the regimental infirmary or hospital would be back in the regimental field train.

On a march in retreat, in a brigade or division, if the regiment is not acting as advance or rear

guard, the distribution of sanitary troops is the same as given for the ordinary march.

If the regiment is marching alone with an advance guard of one battalion, the distribution is that of an ordinary march and the battalion sanitary troops will march with the reserves of the battalion, with possibly one man with support, if such there is. The formation will practically be the same for a regiment acting as advance guard with a battalion as the support—each battalion will carry its personnel as usual—the surgeon will be with the commanding officer, and the battalion forming the support will have one or two men of the sanitary personnel, with the advance party.

In a retreat of a regiment, or a regiment acting as a rear guard, the reserve will be reinforced by the sanitary personnel from the main body of the battalion or regiment, in order that the wounded of the retreating rear guard may be rapidly evacuated ahead of the troops. If ambulances are available, as in a regiment acting independently, it may be well to attach one to the tail of the main body, between it and the reserve of the rear guard, leaving the pack mule and remaining ambulances to march with the leading battalion.

Ambulance companies are divisional sanitary organizations, but for purposes of care and transportation of the sick and wounded, may be attached to separate brigades, which are operating away from the division. Under the conditions of the ordinary march, when hostile contact is not expected, ambulance companies march and camp together, with the exception of one ambulance company, which under proper orders may have its ambulances distributed through the column, one to each regiment, for use in transportation of the disabilities that

occur on the march. (F. S. R. 341.) Under these conditions of the ordinary march, those ambulance companies, not concerned in the regimental service for the day, march as do other organizations; their positions ordinarily in the rear of the field trains when marching as a unit, with their field wagons; when marching with light transportation (pack mules) only the ambulance companies march in advance of the field trains.

Under conditions of untrained, or fatigued personnel, bad weather, or long marches, action may be taken to increase the number of ambulances temporarily attached to the regiment, for the purposes of the march, as much as may be necessary. These ambulances so distributed to the regiments are for use in transportation of the disabled and their equipment, and must not be diverted to any other use. They are under the orders of the Director of Ambulance Companies and their movement will be controlled by him, in carrying out the orders of the surgeon or the commanding officer. At the beginning of an engagement, or at the end of the march the distributed ambulances will be assembled by the orders of the director, usually given through the company commander. All disabled sick in the ambulances at this time, who require more than temporary care or transportation will usually be sent back by the regimental surgeon with the ambulances. When they move to assemble in preparation for an engagement, the disabled will be collected at some central point in the rear for further evacuation, if on arrival at camp, at the probable site of the camp infirmary, or to the field hospital for further treatment and evacuation according to the conditions and orders.

This arrangement of the ambulance companies in column for the ordinary march, is to permit such

use of organizations as may be necessary for the transportation of the disabled, and to permit rapid collection of the disabled on arrival at camp, without unnecessary movement of disabled or transportation.

The ambulance companies whose ambulances are not distributed to the organizations on the march, are held in their position behind the field trains, as they camp at the rear of the center of the division, and ordinarily not more than one is concerned in regimental duty. With this position, they do not become involved in the movement of the field trains to their organizations or on their return; and are in position to join the column for the next day's mrach. The details for march duty with the regiments, will be made by the director, ordinarily by roster, and the positions in column will be determined in a like manner by the Director of Ambulance Companies, acting as a battalion commander.

Changes from the routine order of march, will usually be made on recommendation of the surgeon, in the march order, according to the necessities of the case. This position of the ambulance companies behind the field trains, places them sufficiently far forward to permit, in case of rencontre, advance of the ambulance companies sufficiently early to be of use when required, and yet not have them as far forward as to have them unnecessarily involved in conflict.

The ambulance companies with light transportation, march at the tail of the combatant column; such a position usually is the result of a desire to have the more mobile part of the organizations ready for early use, or is the result of difficult roads, or failure of heavy wheeled transport: either condition, if the ambulance companies were kept behind the heavy transportation of the field trains, might

possibly put them so far back as to render them useless.

The usual order of march of an ambulance company is that of ordinary commands of mixed organizations. The foot troops, the bearer sections with litters, first, followed by the pack mules with the dressing station detachment, next the ambulance detachment, and lastly, the three wagons: The first wagon carries reserve dressings and equipment for the dressing station, and, where possible, accompanies the dressing station party forward as a combat wagon.

The road distance of an ambulance company on the march without elongation is 125 yards motor,—200 yards mule. The Director of Ambulance Companies ordinarily accompanies the ambulance company in advance on the march, such a position places him so that he will be able to receive messages from the front and rear, easily, and yet supervise the work of his organizations as it occurs. This advanced position also gives him an opportunity to familiarize himself with the conditions of roads, terrain, etc. On ordinary marches, particularly when the roads are dusty, the dismounted detachments of the sanitary battalion are frequently marched together, as a matter of comfort, followed by the pack, ambulance and wagon detachments, combined in order of the companies; such action while removing the transportation from immediate control of the commanding officer, does not cause material delay in going into action; as these detachments have medical officers in command, and objection on this score does not hold good—the conditions of the march are certainly improved greatly.

The march in the presence of the enemy, where hostile contact may be expected, requires as it does

with the line troops, a different arrangement of the ambulance companies in the column. With the reinforced brigade, the single ambulance company attached is moved up in advance of the field trains, to the tail of the column of combatant troops; so that it will not be forced to participate in the retirement of the field trains, if such retirement is necessary, and that it may be in readiness for action, should the bridgade deploy for attack or defense, and in case of retreat, be sufficiently advanced to permit detachment of a platoon of ambulances and bearers for duty with the rear guard, for the purpose of expediting the evacuation of the wounded.

The distance from the reserve of the rear guard to the tail of the main body of the brigade, will be about 4,000 yards, a distance that could be traversed by the ambulance company, if necessary, while the brigade is deploying, if it were desirable to bring it up to this point. Such action however would not be contemplated until late in the action, and if the dressing station establishes, it will be well to the rear. The regimental sanitary personnel will be sufficient to care for the wounded until the dressing station can go into action and the position of the ambulance company at the rear of the column is correct, for a column of this size.

With a brigade in retreat, however, if the ambulance company were marched with the leading troops (with the same 4,000 yards from the reserve of the rear guard) in default of wheeled transportation, the wounded resulting from a general rear guard action must be abandoned or carried by hand.

If, as mentioned above, a platoon of 3 ambulances be attached to the reserve of the rear guard, with 5 or 6 litter squads from the bearer detachment, these reinforced by the regimental sanitary person-

nel will be able, under ordinary conditions, to evacuate a considerable portion of the wounded requiring transportation.

With a division marching in the presence of the enemy or when hostile contact may be expected, ambulances will not be distributed to the regiments, but will be held with the ambulance companies. With the normal advance guard of one brigade, one ambulance company will be attached to the advance guard and march usually at the rear of the reserve as the distance from the tail of the reserve to the tail of the combatant troops of the main body will, without elongation, be some seven miles; a distance too great to permit a unit of the size of a brigade to be without medical assisitance, other than the regimental personnel, during the time it would take an ambulance company to come to the front. If a general action is imminent, the advance guard will be engaged for a considerable time and the ambulance company, equipment, and personnel, will be required early. If the advance must continue, this equipment will be required to take over the wounded and release the regimental personnel, so that it can continue with its command. If a retreat is required, this organization well up to the scene of action, offers the only means of evacuation of the wounded.

The positions of the sanitary units of a division in retreat are identical with those of a march formation with advance guard, except, that organizations are faced about, and, if necessity arises for delaying actions of some duration, the ambulance companies with the brigade rear guard may be reinforced by additional ambulance and bearer platoons, in order to expedite the evacuation of the wounded of this force, which must retreat soon.

Flank guards of a brigade or more, when detached a sufficient distance from the main body to warrant such action, should be furnished a proportional amount of sanitary assistance. As such a command must keep in movement consonant with the movement of the main body, it must not be impeded by the disabled, and the allowance of ambulance company personnel and equipment should be liberal. The method of distribution of sanitary personnel of a flank guard on the march is that of a brigade or division when hostile contact is expected.

The distribution of the three ambulance companies on the march with a cavalry division conforms to that of an infantry division, except that on account of the superior mobility of the cavalry division on marches where contact may be expected, it may be frequently necessary to carry the packs of the dressing station equipment and bearer detachment in ambulances, leading the unloaded pack mules from the tails of the ambulances in order to keep up with the command; the wagon transportation being directed to follow at best speed consistent with constant marching. Such an arrangement permits these organizations to go forward with all the speed that can be expected from mule drawn wheel transport. When getting into ground unsuitable for wheeled transportation, the pack mules can be reloaded and the bearer detachment move out on foot from the ambulance head with light transportation.

The position of the field hospitals of an infantry division on an ordinary march is at the rear of the ambulance companies, which are preceded by the field trains—the director of the field hospitals usually marches with the most advanced organization . The

duties of the field hospitals on the ordinary march are limited to arranging for establishment of sufficient equipment to shelter the daily increment of disabled, prior to evacuation. As these organizations camp, usually with the ambulance companies, in a position to cover the rear of the center of the divisional camp, their place in the column conincides with this intent and permits entrance into the column the following day without confusion.

The necessity of use of field hospitals in action, such as would occur only under the conditions of a meeting engagement, does not require, and in fact forbids early establishment; and the position of the field hospitals in this column, some 8 miles from the head of the main body, keeps them well out of range of light artillery fire and yet permits arrival in proper position within two hours if necessary. While the field service regulations require a field hospital to be located, so as to permit early care of the sick on arrival at camp, the camp infirmary, marching at the rear of the brigade, now provides for and can do this, until the establishment of the field hospital. Under conditions where delays of trains may occur, a field hospital may be marched at the tail of the main body, in order to place it in position to establish an hour and a quarter earlier. As the road space of a field hospital company is only 90-100 yards, such an arrangement will have little effect in displacing the field trains to the rear.

Field hospitals with organizations marching when hostile contact is expected, march with the ambulance companies in advance of the field trains, some 6½ miles from the head of the main body in position to halt in readiness to establish or march forward according to the necessities; should the division deploy, this position in the column puts

them well up to the front and clears them from being involved in the field trains should action occur. This is essential as the transportation of these organizations, field wagons, is heavily loaded and cannot move with rapidity. Position of these organizations further forward with the column would expose them to involvement in the movements of the combatant troops and possibly to artillery fire with no advantage, as these organizations will not ordinarily be needed until the action has well developed, and in their present position have ample time to establish whenever ordered.

Field hospitals attached to brigades acting independently, conform to the same conditions as in the march with larger units. Advance, rear, and flank guards of less than a division, do not ordinarily have field hospitals attached to them, but depend upon the field hospitals attached to the main body.

In the retreat, the positions of the field hospitals are the same as in the column on a march to the front, the advance when hostile contact is expected, except that the organizations are faced about. Owing to the slow movement of these organizations, the transportation and material could not be used nearer the enemy, but the personnel will be available to assist the ambulance companies with litter bearers, in evacuating from the front, and for care of excess wounded sent back to the sanitary, field, ammunition, and supply wagons, for transportation.

All movements of the divisional sanitary units other than those routine to the march, are directly controlled by orders from headquarters of the command, usually upon the recommendation of the surgeon of the command. Detachments for ambulance duty with regiments, advance, rear, and flank guards,

are made by roster, where possible; where organizations are on continued duty as flank guards, etc., it is advisable not to make frequent change of sanitary units, on account of the unnecessary movement involved. The orders with regard to the sanitary troops may come from the combatant commander, or from the surgeon, when such authority is delegated to him.

The relations of the lines of communications, sanitary service, to the march in campaign consists in the renewal of the technical supplies of the service, by timely issues, renewal of personnel, and the evacuation and care of the disabled. With the ordinary march these duties lie largely under the control of the surgeon, advance group, of the line of communications, whose duties are practically those of an advance field and forwarding agent for the surgeon of the base group. With the line of communications short, and near the base, and efficient transport lines by rail, water, or motor, betwen the base and the transportation head, there will be little intervening in the way of sanitary establishments or equipment; but as the line extends, establishments and units must be brought up and placed in accordance with conditions and requirements. Under the conditions of the long line of communications, intermediate medical groups may be required.

The duty of supply for the sanitary units, which start the campaign with sufficient medical supplies for one month, will be handled by timely issue from the advance medical depot, usually at a rail, water, or motor head. These supplies for issue must be sent forward to the distributing point by lines of communications transportation (as the abolition of the Medical Reserve Supply Company by recent action, furnishes no supply wagons for this purpose),

and will there be taken over by field wagons of the ambulance company and field hospital companies, which will issue to the organizations, as required. Requisitions for supplies required, will come from the chief surgeon of the units requiring these supplies and probably they will be issued under his direction. This matter of issue under the new conditions has not been worked out as yet, but the method given, follows the former method. Issues to regimental sanitary service can be made by using the regimental pack mule as transport, or by the camp infirmary wagon attached to each brigade. The technical supplies required consist of medicines, dressings, and hospital stores, such as arrow-root, chocolate, extract of beef, spices, soap, candles, evaporated milk, tinned soups, etc., all packed in convenient standardized containers; the medicines and foods in tin, whenever their chemical properties permit. Shipments of supplies of this character, on account of the urgent need for them, usually will be accompanied to the distributing point by a non-commissioned officer of the sanitary service of the advance group, in order to insure rapidity and certainty of delivery.

The service of the evacuation of the disabled sick of the march in the campaign, will be organized on the same basis as that for those resulting from combat. The daily increment of sick for trained troops in campaign as given by Straub, will average about one per cent, divided in to the following classes:

1. Sick in Quarters { (a) Able to do duty (light) 0.3%
   (b) Unable to do any duty 0.3%
2. Sick in Hospital { (c) Slight ---------- 0.15%
   (d) Severe ---------- 0.15%

Class	Duration of treatment	Average days of disability	Day when maximum number is reached
a,	3 days	3	4
b,	3— 5 days	4	6
c,	5—14 days	10	15
d,	14—50 days	32	51

But with relatively untrained troops or difficult conditions of march, weather, improper foot, etc., these averages may be much increased—even from 5 to 15%.

The cases covered by classes a and b, amounting to 6 per M, will under ordinary conditions of march recover within three or four days; a considerable number of these may be able to march without equipment or ride on the field wagons and be available as guards, etc. It would be uneconomical to send these to the rear and ordinarily they can be cared for in the regiment or at the camp infirmary and sheltered with their own equipment. Classes c and d, will average from ten to thirty days lost by sickness and will require hospital treatment. Such cases cannot accompany the command and must be evacuated. Sick call will be held by the attached sanitary personnel and the light cases separated from those requiring evacaution to the rear. The light cases will be treated by the regimental sanitary personnel or if their equipment is sufficient, at the camp infirmary; a classified sick report will be made to the division surgeon and the evacuation cases taken to the camp infirmary, in order that they may be collected by the ambulance detachments assigned to this

duty. From the brigade collecting point the evacuation cases are taken to the field hospitals, designated to receive these cases, pending evacuation or if the lines of communication, sanitary transport head, such as a transport column, or hospital ship, or train, is sufficiently near to require no extended movement by the ambulance company, which in all probability has made considerable march, the disabled may be delivered directly to the lines of communication; such conditions are unusual, and the chief surgeon will ordinarily require delivery to the field hospitals.

The Director of Field Hospitals, like the Director of Ambulance Companies, will receive information from the division surgeon, as to the number of evacuation cases, and each of these officers will have designated the units to take care of the transportation and shelter these cases, and they will be held at the field hospitals pending arrival of the lines of communication, transport column. These cases for a division will amount to about 75 men, of which a considerable number will be recument. The total sitting for an ambulance company of 12 ambulances is at most 108; the total recumbents 48. Ordinarily, one ambulance company will be sufficient to collect them, and for purposes of economy in travel, that company assigned for duty with regiments on the march, will usually be designated as a routine for this duty, by the Director of Ambulance Companies, as it has marched in with the regiments and is already loaded with some of the cases and will collect the remainder while at the regimental camp, or at the infirmary.

The capacity of the field hospital is 216 beds, it will set up such bedding units, as required for the disabled, using available shelter, when possible, in place of tentage.

The division surgeon will notify the lines of communications of the number, and classification of cases, as soon as they are reported, and give the point at which they are collected. Owing to the fact that lines of march may be changed, and means of transportation fail, the advance surgeon will have his transport column of mule ambulances or motors well up to the tail of the column, in the zone of advance at all times, in order that field hospitals may be evacuated as speedily as possible. Evacuation of the disabled will be effected as rapidly as possible to rail or water transportation heads, if practicable, distance, weather, and road conditions, considered. If evacuation can be made by rail or water, as when the line of march follows or intersects such routes of transportation, hospital trains or boats, will be arranged for to arrive at a place and time agreed upon by the division surgeon and the advance surgeon. If evacuation must be by road, such a route should be selected as will be different where possible, from that traversed by the ammunition and general supply trains, in order to prevent interruption and congestion of traffic. Rest stations must be established, if the number of wounded and distance of march warrant them. Evacuation by rail or water will require receiving detachments at the transportation head, with minor fixed hospitals at the refilling point, or back further on the line for arrest of the cases of lesser gravity; with rest and feeding stations for improvised ambulance trains.

During the march in campaign, the evacuation hospitals attached to the line of communications, will be kept well up to the head of the line, so that they may be available for rapid movement to the front. These units are without specially assigned transpor-

tation and must use water or rail transportation where possible.

Wagon or motor transport from the rail or water head, must come from the lines of communication for the final movement to the relief of the evacuation hospitals. Under conditions of necessity, these organizations may be used as receiving hospitals on the lines of communications, but their mobility must be impaired as little as possible, and when filled, substitute organizations must be sent up from the rear.

Convalescent camps, and sanitary detachments, may be established in the advance medical section of the lines of communications under special conditions, but ordinarily these will be back in the intermediate or base groups.

The service of supply of sanitary personnel begins within the home territory. Drafts of sanitary troops are forwarded to the base of the lines of communications, and held in casual camps, under the control of the surgeon, L of C, and under the authority of the commanding officer, L of C, assigned to duty on the L of C, for organization of new units, such as fixed hospitals, rest stations, convalescent camps, etc., or to the organization in the zone of the advance. The relations between the sanitary service of the zone of advance, with the L of C, must be carefully accorded, or much difficulty will result. Constant communication must exist between these sections, and between the sections of the L of C, themselves; and the various officers of these sections should be given wide latitude, as to arrangement of the duties of their service.

The essential features of the sanitary service in campaign are prevention of disease, and care, and prompt graded evacuation of the disabled, in such

a manner as to keep the units organized, supplied, and unencumbered; so that they will be available for use under stress of a large increment from epidemic or combat—and, yet, move no case further to the rear than his condition requires.

Lecture V

SANITARY SERVICE OF THE CAMP

THE sanitary service of the camp should begin with an examination of the campsite, as to position, drainage, soil, vegetation, shade, evidence of recent occupation, medical history of the tract and vicinity, and presence of objectionable insects; the investigation of the source, purity, and quantity of water supply, and means of distribution—food supply, as to quantity and quality, purity and method of handling, and quantity and quality of wood and straw, and location and availability; and the location of buildings, roads, and means of transportation, that might be available in the care or evacuation of the disabled. Such an investigation should be made for every camp or bivouac by a medical officer, sent ahead with the quartermaster, who will perform similar duties in conjunction with the medical officer.

Military necessity under stress of campaign or combat, may require that the various considerations inquired into, be ignored in part or altogether—for very temporary camps or bivouacs, for large or small commands, but early search for proper sites, fulfilling the conditions to be discussed later, will result in such material advantage to the command, in the case of supply, early establishment without confusion, comfort and preservation of good feeling and health, that such action should never be omitted either for march bivouacs and camps, or semi-permanent camps.

The position or situation of the camp with relation to towns, villages, rail or water transportation lines, and roads, must be considered from the standpoint of supply, shelter, and means of transportation for the command and the sanitary service, as well as with regard to transmission of communicable diseases within the native population, or in the command. The situation of the campsite, with regard to protection from prevailing winds or exposure to desirable breezes; proximity to insect producing streams, swamps, or collection of decomposing organic matter; possibility of flooding in wet weather; or dust, or sand storms in the dry season; prevalence of fogs, and nearness to potable water and other supplies in sufficient quantity; and accessability to transportation, must be given due weight. Poor drainage or a high level of ground water will not only affect the comfort of the command by keeping them constantly damp and possibly cold, but will actually conduce to transmission of infections, by interfering with disposal of waste, and may produce collections of water sufficient to produce breeding of disease carrying insects—aside from the material damage done to equipment and dispositions.

Soil conditions such as presence of a high content or organic matter, or clay, conducing to retention of moisture, fine sand, to the extent of dustiness, are objectionable and unhealthy and should be avoided.

Rank vegetation on a campsite furnishes shelter for insects, prevents drying of soil sufficient to permit a dry camp or bivouac, collects dew and rain, and in general indicates a high organic content and high ground water, and should be avoided, or if time permits, eliminated. Excessive shade produces the same conditions that does rank vegetation and

should be avoided. Campsites should in general, be in the open, not only to give the soil the benefit of the drying effects of the sun, but also that most important effect, disinfection. Shade is as valuable and enjoyable for the soldier as for any one else and shade trees in the vicinity of a camp in the summer season are highly desirable, but given the choice of canvas under the sun or shade, choose the sun.

Careful examination of the history of cholera and typhoid in the military service has forced the conclusion that commands, camping on sites formerly occupied by infected contingents, have frequently derived their infection by occupation of old sites, and has led to the avoidance of these, wherever possible. Experience with typhoid in our own service during the Spanish War, that of the English in the Boer War, and that of the Germans in the Franco-Prussian War has led to this conclusion, which was confirmed by bacteriological investigation of the soil and water supply. The presence of disease carrying insects must be considered with the medical history of the vicinity of the camp; such history can usually be elicited by questioning the people living in the neighborhood, or consulting town registers, or health officers, with regard to the prevalence of typhoid fever, cholera, dysentery, malaria, yellow-fever, dengue, typhus and cerebro-spinal meningitis.

Typhus is a disease which we need not consider ordinarily in the United States but, since the constant prevalence of an attentuated form in New York has been proven by Brill and confirmed by the discovery of the causative micro-organism and method of transmission by the body louse, this disease, always present in Mexico, must be of military interest. This particularly in view of its appearance in some European Armies, under good sanitary con-

trol, in the present war. Presence of insects, such as fleas, mosquitos, ticks, and bugs, and lice, must not only be considered from the standpoint of disease carriers, but also from consideration of personnal comfort; for while the buffalo gnat, the black flies, the Canadian flies, and the various midges, and deer flies, may not be as yet implicated in the carriage of diseases, their presence in considerable number not only will worry a command to the point of complete loss of rest, but they may materially affect the animal transportation. Investigation of the water supply will be made by gross examination, as to color, odor, taste, with a survey of the source, water-shed, with an inquiry as to the history and use of the water and natives using it; and, if time and apparatus be at hand, a chemical and bacteriological examination. The quantity must be measured, and estimation of the amount required by the command must be made on the basis of the need, for the type, and duration of the camp, and the character of methods of distribution and sanitary installations. The food supply will also be investigated on the same basis as is that of the water, particular attention being given to milk and beverages, and method of handling. The quantity of the local food supply will be investigated with view to procurement of special diet articles for use of the sanitary establishments, as will also the quality, quantity, and location of wood, straw, and forage—items essential to the comfort of the sick at all times and to the whole command in inclement weather, when a timely certificate, given by the medical officer to the quartermaster, may result in the avoidance of a materially increased sick report.

The investigation of means of shelter and transportation and condition and direction of roads, may

later have an important value in the location of sanitary units and the evacuation of the wounded; and should not be neglected by the medical officer, sent in advance, as he will usually have time and opportunities to survey the country before it is occupied by troops, and can acquire a much better idea of the general conditions, than officers arriving later.

Having reported the results of his sanitary survey of the campsites, the sanitary inspector will consult with the advance quartermaster as to distribution of water guards and water supply or distribution points, and location of unit camps, in order to prevent contamination. In large units, ordinarily a special quartermaster and sanitary officer will be detailed for selection of the site, the march camp, or permanent camp, and they should co-ordinate their duties as much as possible on the basis of practical efficiency.

Sanitary Routine

Given the campsite selected, and the various investigations completed, the sanitary inspector reports the results to the commanding officer, or the chief surgeon, if there be one. If the camp is to be a permanent one, the sanitary service concerns itself with the supervision of the various sanitary establishments of the details of the handling and periodical examination of the water supply, the disposal of waste water, and wastes such as human and animal discharges, kitchen wastes, the examination of the food supply and its preparation, the investigation of the health and habits of the command; the prevention of disease, and the care and evacuation of the sick, and the organization and training of the sanitary personnel.

Orders concerning the special detail of the sanitation of the particular camp are recommended, and periodical inspection is made, both by the general sanitary inspector of the camp, and also by the senior medical officer. Special sites for the camps of divisional sanitary units are arranged for, and camp hospitals are established. Camp hospitals are a revived feature of our service, the particular function of which is to care for the temporarily or semi-permanently ill, pending evacuation, in order to prevent the field hospitals from becoming immobilized with disabled and thus lose the freedom of action necessary for training or movement with the combatant organization to which attached. The camp infirmary will be situated, where a camp conforms to the scheme laid down in the diagram in field service regulations, in such a position as to permit ready access from all of the regiments of the brigade to which attached, and with personnel assigned by the senior medical officer of the brigade from the regiments which the infirmary serves; and will be available as a collecting point for temporary treatment and evacuation of the sick. During occupation of the camp, the ambulance companies will be available for the transportation of the sick from the camp infirmaries to the camp hospital, and from there to the evacuation transport head, if the command is not under campaign conditions or the distance too far. In such case the line of communications, if they exist, will be called upon to perform evacuation from the camp hospital. The regimental sanitary personnel will, in the permanent camp, busy themselves with the physical examination of the command with respect to their general physical condition and freedom from disease, and fitness for the field, with the examinations of recruits, the ad-

ministration of prophylactics for prevention of infectious diseases, and the examination and the care of the sick and the sanitary inspection of the campsite, and environs of the command to which attached, and the instruction of the sanitary personnel in their duties, and the officers of the combatant units in the first aid and personal hygiene.

For purposes of instruction and duty the regimental sanitary personnel may be divided into squadron or battalion sections as outlined in previous lectures. With this system in use, sick call will be held in each battalion by the medical officer on duty with the battalion assisted by the noncommissioned officer on duty with the battalion section and a memorandum sick report sent to the regimental surgeon, together with such sick as require treatment not afforded by the personal equipment. The battalion sick reports will be consolidated and the sick requiring special treatment or evacuation will be sent to the camp infirmaries.

As a routine, ambulance detachments will visit the camp infirmaries twice daily, and specially in emergency, and clear them to the camp or field hospitals. For emergency duty in treatment of the sick, etc., one battalion sanitary personnel unit will be detailed for duty—the medical officer being required to act as regimental sanitary inspector for the day; to attend to emergency calls and examinations, such as the examination of recruits, etc., the enlisted personnel assisting in this work, night nursing, etc., in addition to their routine.

The duty tour for the emergency squad is usually 24 hours, during which time they will remain in the vicinity of the regimental sanitary equipment and camp. The emergency officer will mark his tent by a red cross guidon by day, and a green lan-

tern at night, so that his whereabouts may be known, and will notify the emergency sergeant of his whereabouts, if it is necessary that he leave the vicinity of his duty and assignment.

Each medical officer will form a sanitary squad of his battalion unit and will be held responsible by the surgeon for the sanitary inspection and condition of the area assigned to his battalion. The sanitary squads will be responsible for the sterilization or treatment of the water for their battalion and the supervision of the details of disposal of wastes, sanitary police of the area, including drainage and oiling of pools, policing of latrines, and abolition of sanitary nuisances.

The battalion surgeon will observe the condition of the battalion personnel as to health, habits, clothing, and food suppy, making frequent inspections of meals; will be charged with the physical examination of the personnel under his charge and will be authorized to make direct recommendations to the battalion or company commanders, concerned, for the betterment of sanitary conditions in accordance with the policy laid down by the regimental surgeon.

The division of duty in this manner does not relieve the regimental surgeon from responsibility or duty in this connection, as he should make daily sanitary inspections of the camp and command, but permits more rapid amelioration of sanitary conditions and gives each medical officer a definite personnel and unit to which he is attached. Such continuity of duty gives the medical officer a closer knowledge of the individuals under his care and supervision, and produces the best results in medical and general service.

The enlisted sanitary personnel become acquainted with the individuals of the battalion, with

which they are on duty and are able to furnish valuable information, both to the combatant personnel as to sanitary proceedings, and to the medical officer as to the habits of the men as affecting their general status. Sick call held in the battalion area instead of at the regimental aid station, will be finished without loss of time, and will generally carry less malingering to escape fatigue duties; the service is brought to the men, by an officer who knows them, under conditions which will exist more or less in campaign for which all are being trained.

The sanitary inspections of the camps, kitchens, latrines, incinerators, dumps, etc., will be made at such an hour that will permit completion of the routine police of these installations, in order to give an idea as to the character of this work; and, in order that this may be properly accomplished, the general sanitary order must fix a time for the completion of this police. Inspections will also be made at odd times in order to gain information, as to whether the maintenance of this police through the entire day is satisfactory. Ordinarily the battalion surgeons will accompany the regimental surgeon on his tour through their areas; and the regimental surgeon will accompany the camp sanitary inspector through the regiment. At these inspections, sanitary defects will be noted, and memoranda made by the interested medical officers. The medical officers responsible for the areas found defective will report them to the combatant officer responsible, with suggestions as to correction, and, if thought necessary to the commanding officer of the unit, either verbally or in writing. Frequently camp or regimental orders require corrections of defects reported by a sanitary inspector without requiring reference to the camp or regimental commander, and it is customary

to invite attention of regimental, battalion, or company commander to sanitary defects that require only local action, without making special report to higher authority, making written note of such action. Such direct methods, if carried out in proper manner, prevent delays, and ordinarily accomplish the results most satisfactorily.

The first sanitary inspection occurs in the fixed camp in the morning usually about 9-00 o'clock, an hour at which routine police of kitchens, streets, latrines, picket lines, and areas, is usually completed, leaving the remainder of the morning for administrative duties and instruction. At this time will occur the bi-weekly physical examination of the command, usually in the company streets, by the medical officers combined, moving from one battalion to another, in order to perform this duty as rapidly as possible with least exposure. In camps where it is difficult to secure security from observation, it is well to fix a time of assembly, immediately after reveille for this purpose, at which time there is sufficient light and freedom from visitors; but in bad weather, inclined to be chilly, an hour nearer noon is advisable.

The administration of prophylactics by hypodermic injection, will usually be done in mobilization camps, at camp or field hospitals, in preparation for field service; but exposure to special diseases may require administration in the field. This will usually be done by combining all available equipment and marching sections of the command, to the camp infirmaries, or if the command be small to the aid point; prophylactics for prevention of venereal diseases will be available at the organization sanitary aid point.

In camps of instruction and mobilization, drill

and instruction should be carried out thoroughly, and the regimental surgeon will not only instruct the sanitary troops proper in their duties in camp, march, and combat, but will, if authorized, have the band participate with the sanitary troops in this instruction. The band is an essential aid to the sanitary service in combat and must not only receive drill and instruction for this service, but with the sanitary service, receive special physical training to prepare them for the severe effort which will be required of them. Neither the duties of the personnel of the band, or of the Hospital Corps in time of peace, give them the physical fitness that litter carriage requires and the requirements of combat will find them inefficient, unless this is done.

The entire command must be instructed in the hygiene of the individual, and of the camp, march, and battle, and, while the regulations require instruction by the company officers, it is thought best that in preparation for campaign, this instruction be given the regimental medical officers, who are especially qualified in this work. The command should be instructed in the construction, use and police of the various devices required in the sanitation of the permanent or the march camp, and one definite system should be constructed and demonstrated for each condition. At present so many types of camp sanitary installations are used that much confusion results. Most of these devices are good, but many of the best require so much labor, material, and time in their preparation, that their construction and use as a means of camp sanitation is inadvisable. In order to attain some idea of standard measures or devices for camp sanitation, these will be discussed as briefly as possible.

Water Supply

Amount required depends upon type of camp, method of distribution or supply, sanitary installations, and weather. Camps with piped supply to company kitchens, shower baths, and water carriage sewer system in hot weather will require 25 gallons per diem for each man and ten gallons for each animal. Bivouacs and march camps will require a minimum, one gallon for each man for drinking and food, and from five to seven gallons to each animal. This where water must be carried by hand for personal and kitchen use, and the animals taken to it. For purposes of ablution and kitchen service, this must be increased by at least three gallons per man. Requirements of procurement from natural containers as streams, ponds, springs, and wells, will require designation of special points for procurement for water for drinking, cooking, and for use of animals, and washing and bathing, in order to prevent pollution and soiling; and guards to enforce the regulations. These arrangements will be made in advance as mentioned above and required by Field Service Regulations, 240; and consideration given as to the most available means of storage and disinfection, if such be found necessary.

Means for storage must be taken in case of insufficient supply early before time of expected use, ordinarily improvised from materials at hand. In the choice of these materials care must be taken that these are sufficiently clean for the purpose, and if there is any doubt of the purity of the water or storage containers, measures of disinfection must be arranged for. At the present date there are three methods by which this may be accomplished with equipment at hand or improvised in march camps or bivouacs. Boiling in individual or organization

containers, precipitation with chemicals and filtration with the various types of filters, or sterilization by chemicals in special containers. Of these the tin cup and canteen, or the company kettles serve for boiling; for precipitation and filtration the Darnall filter as issued is satisfactory; and for chemical sterilization the Lyster water bag serves most satisfactorily, on account of ease of transport and reliability. The Lyster bag is now a part of the company equipment. The last two methods, however, require special equipment and are not always at hand. Where possible the matter of water sterilization should be turned over to the sanitary service, in order to give it responsible supervision, and can ordinarily be handled by the battalion sanitary detachment, if it is afforded transportation or aid for procurement and delivery. It can be considered as constantly true that water from the average stream or pond in any moderately populated area is infected and will require sterilization. If this is so, some special sterilization apparatus will be necessary. Of these the most efficient, bulk, weight, and delivery considered, is the bag with the chemical agents.

For permanent camps the water should be delivered in such a manner that it will not require treatment by the troops and, if such action is necessary, treatment must be done at a central plant, under proper direction and control, with the usual bacteriological checks by a laboratory designated for this purpose.

Care must be taken in camps supplied by pipe to prevent waste and give sufficient drainage about points of delivery. It cannot be too much impressed upon organization commanders that wells, as sources

of water supply, cannot but be regarded with suspicion with regard to capacity.

Ordinarily there is at hand no method of judging capacity except by the testimony of inhabitants. The demands of a single family or group of families upon a given well is usually so small that the ordinary well gets a reputation for inexhaustibility. The first 15 minutes or half hour after the arrival of a regiment, finds the water taken from the two or three wells available, roily, and another quarter of an hour, frequently finds them exhausted. If they are not exhausted the constant demand has brought in surface water, too rapidly filtered through the earth to insure precipitation or nitrification, and as a result we find the neighborhood privy vault, cesspool, or barnyard puddle contributing its moiety to the liquid.

The average regiment can wreck a pump, curb and casing in half an hour, and, if method of removal is not regulated and controlled, pollute the well contents by drippage from dirty boots within that time. The essentials for preservation of a well and its equipment is a guard who will require that no vessel smaller than a bucket is filled at the well and that the method of removal, proceed carefully under his control without wastage, and that no refilling be done within forty feet of the well, and that removed from trails which would lead to muddying and soiling of the curb.

An almost indispensable equipment for the procurement of water for a battalion or regiment in campaign is a horizontal marine pump, with 50 feet of three-inch suction and 25 feet of delivery hose. Such an apparatus is relatively indestructible and will give sufficient delivery for the command without soiling of the source of supply. It can be controlled

by one sentry, and worked by the company water detail. After a command is trained to its use, no sentry is required other than for general patrol of the general water supply line.

Food Supply

The sanitary service will examine the food supply from all sources with regard to its quantity, quality, source, methods of handling and preparation, this by inspection of the quartermaster issues, method of transport to the organizations and care and storage therein. Company kitchens and messes will be inspected with regard to their cleanliness, the method of storage and handling food, and the personnel of the kitchen will be scrutinized, with regard to possibility of their being carriers of infectious diseases.

Under the stress of march conditions and the necessity of local purchases the especial care in examining food supplies, that is used in time of peace may not be used, and the supply from the quartermaster must be as carefully inspected, as that offered for sale from civil sources. Inspection of abattoirs, storage plants, butcher shops, groceries, and dairies furnishing supplies must be made and action be taken to prevent entrance into camp of supplies from non-inspected and unsanitary sources. The general provision that articles shall not be offered for sale within the camp limits except at authorized establishments, under military control, will materially limit consumption of unsanitary foods, and, under proper conditions the visiting of unsanitary establishments may be forbidden. With large forces the use of a mobile laboratory, will materially aid the work of examination of food and water supply. Such organizations are a feature of the sanitary ser-

vice of all European Armies and are authorized and have been used in our own.

Disposal of Wastes

Like the water supply the methods of disposal of wastes of camps are dependent upon permanency, purpose, and supply of the camp, the environs, character of the soil, the drainage, and the appropriation available; and the individual who adapts his methods to these conflicting conditions will accomplish the best results.

Permanent camps and cantonments will undoubtedly save in the long run by installing a proper water carriage system, for disposal of body discharges, and liquid wastes, but ordinarily, the initial expense is too great, in consideration of the allotments, for this purpose. The danger of production of epidemic diseases by insect carriage from human discharges, as proven within the last twenty years, has caused the adoption of many expedients for the proper disposal of feces, urine, and garbage; aimed at prevention of contact with or breeding of flies in wastes. These vary from destruction of wastes by fire to storage and disinfection.

Destruction of human wastes by fire is undoubtedly an ideal method, but it has been found expensive, and the various incinerators used have been so bulky and heavy, that it is only adapted to fixed or permanent camps and cantonments; and there are other less expensive means that have been found effective. The average initial cost per seat of the latrine incinerator has been some forty dollars, and, while they have materially safeguarded health, these devices have not been an unalloyed comfort, as anyone can testify who has had his appetite materially affected by fumes from the stewing contents of the

pans carried by on an unpropitious breeze. Another objection to these latrine incinerators is that in ordinary camps conditions will require use of some extemporized latrine, usually some type of trench, and troops should be trained in their use and construction under favorable conditions.

The large camps are ordinarily established for purposes of instruction, mobilization, or concentration; usually with personnel that requires instruction in general, and they should here be shown the latrine that will be used by them in campaign. For camps of more than one day, a trench of sufficient width (2 feet), and depth according to probable duration of the camp, and length proportioned to the command it is to serve, is required. Seats should be in the proportions of one to each ten men and length on the basis of 2½ feet to each seat. F.S.R. 246, provides for 6 feet as the depth for permanent camps, such depths should depend upon the character of the soil formations.

Access by flies must be prevented by police with earth or other suitable material, if flylight covers cannot be made, and some means of support such as the pole in ordinary use should be provided. It is needless to say that where possible arrangements should be made for seat covers. In arranging the seat hole, it will be found an excellent plan to make it sufficiently long from front to rear, and this can be done by cutting out a notch in the front and rear for the purpose of preventing contact with the seat, at these points, and soiling by urine and feces. A special urine trough protected from flies by use of crude oil should be provided where possible. A very necessary precaution to prevent flooding is the construction of a ditch or dike well away from the trench to prevent access by storm water. The burn-

ing of oil and straw or similar material does not accomplish disinfection to any extent, but does destroy fly eggs laid on the surface and furnishes a layer of oily ashes and soot, which cover the surface and walls of the pit and renders it repugnant to flies. A growing practice in burning out of latrines is to do this without removing the box. This method prevents the constant removal of the box, with necessity for closing up crevices and fills the interior and all cracks with a smoky soot, that serves to keep flies away. If properly handled the boxes and shelter will not be burned. The only objection to this method is that the seats become smoked and blackened and are unsightly.

Straddle trenches of the width of a spade, the length of a spade and handle, and the depth of half of the length of a spade and handle are provided for one night march camps, these are provided in the proportion of one to ten men, and should be placed parallel to each other, with long axis parallel to the company street, at a considerable distance away, so as to permit construction of new trenches if necessary nearer the company in order that filled trenches may not be traversed in going to new ones. The earth removed should be thrown to the end nearest the company, instead of on the long sides and used for policing. The psychology of the use of the straddle trench is interesting. All latrines should be located and drained in such a manner as to prevent pollution of the water supply.

In permanent camps urine cans should be used in the company streets, between darkness and reveille, to prevent pollution of the camp ground. The garbage cans used for this purpose should be removed and emptied immediately after reveille in the latrine for this purpose, and burned out and sunned.

Lights should be kept burning in the latrines and at the urine cans during darkness.

In addition to the means for disposal of human discharges given, the Reed trough, with the so-called odorless excavator have been used at times. These have been found ditry and objectionable, besides liable to disarrangement. In permanent camps with high ground water, as found on the coast or in river villages, difficulty will be found with trench latrines; here a dry earth system will be found the least expensive in actual cost; but here as well as with the Reed trough, objection on account of liability of scattering removed material, can be raised.

Kitchen waste of permanent camps or semi-permanent camps is best disposed of by incinerators, preferably in the camp kitchen incinerator, which if properly constructed and administered will dispose of all dry and liquid garbage of the company including waste proper and sweepings. The essentials of this sanitary installation are simplicity of construction and management, with efficiency and economy of fuel. Various devices, such as the beehive, the Alamo, and many others have been used and all have merit; but most of them require considerable time, labor, and special material, and have not the almost universal applicability of the simpler forms. Of these, probably the simplest is a trench 5 feet long, $2\frac{1}{2}$ feet wide and one foot deep, filled with stones thrown in loosely to the ground level. On the long side of the trench, stone walls one foot high and eighteen inches wide are placed and backed by earth, such a trench will accommodate two or three sticks of cord-wood and if kitchen liquids are poured over the stones on the sides and ends, in small amounts, from time to time, will consume these and all of the relatively dry garbage of the company. The ends

are left open for the removal of debris, draught, and the placing of wood. Experiments have shown that sufficient heat for evaporation from an ordinary fire penetrates the stone bed, only to the distance of one foot, and additional depth is not only a waste of labor but objectionable in that it creates a layer of undestroyed putrescent material at the bottom of the trench. The stones selected for use in these incinerators should be about 8 or 10 inches in diameter and as fire resistant as possible. These incinerators owing to destruction of the stone by heat and water require reconstruction from time to time. For a company of ordinary size, larger pit incinerators are unnecessary and wasteful of fuel. The incinerator trench should be diked or ditched to prevent flooding.

In addition to the ordinary garbage, tin cans should be well burned out, to destroy organic matter. Incinerator debris should be removed twice daily and stacked for removal; as it is innocuous, it need not be covered.

Experience has shown that many difficulties of administration and control cause the larger improvised incinerators, made for use of battalions, to be inefficient and uneconomical. The company incinerator has proven its worth, is subject to direct control and should be used as a matter of training.

Kitchen wastes are usually disposed of in march camps and bivouacs, by use of kitchen sink pits, with diameter and depth varied to suit the size of the command and the length of use. They should be policed with earth and ditched in a manner similar to trench latrines. All trenches must be filled and banked on breaking camp.

The disposal of manure and care of the picket lines is important in view of the fact tha the most common source of flies in camps are collections of

manure: while flies will breed under favorable circumstances in almost any decomposing organic matter, which is not repulsive or poisonous to them on account of the contained chemicals, their chief breeding ground is excrement of animals and man.

Ordinary police of the camp is usually sufficient to prevent, destroy, or remove ordinary collections of organic matter, but the ubiquity of horse droppings, and the urine soaked ground of the picket line, afford excellent breeding places, which are promptly used by flies. Under ordinary weather conditions of summer, the fly matures in from ten to fourteen days, and destruction of organic material must occur within this lesser limit. In order to prevent increase of flies; action must be taken to limit movements of horses and mules in the vicinity of the camps, to the limits of the corral, and designated roads, which will be reguarly policed and require special attention to the removal of all droppings in and near the camp area. Action must be taken to designate hitching points for animals, and forbid general entrance to camp streets. The manure should be gathered from the roads, picket lines, and camps, and removed to a distance from the camp and burned. If arrangement is made with civilians to dispose of this for fertilizer, care must be taken to see that it is removed at least a fly-flight from camp, and preferably spread out on the ground it is to cover.

Thin layers of manure will dry out sufficiently, to furnish no available pabulum for larvae, and are not objectionable. Horse manure, unbroken, is covered by a fine pellicle of mucus, which favors retention of moisture and development of larvae. When this is broken it dries quickly and is unfavorable soil for growth of maggots.

The soil of stalls, and of the picket lines is a fruitful source of flies, however well they are swept, as the maggots find a hospitable environment and rich food supply in urine-soaked earth and penetrate it frequently to the depth of six inches and undergo transformation into the perfect fly and emerge from the burrows, ready to play their distinct game of pussy wants a corner, between the camp latrine and the soup tureen.

Careful scraping of the picket line to the depth of an inch or so, and thoroughly burning over with straw and petroleum, three times a week, will destroy eggs and immature larvae which will not have penetrated far beneath the surface in the short interval of time between burnings. It would seem that consideration of the life history of the flies and the probability of the short duration of march camps would not require enforcement of the sanitary measures outlined for disposal of wastes of camps of an impermanent nature. It must be remembered, however, that the single organization represented in this camp may be followed by others and the same considerations that caused the selection of this site may cause selection by another in this vicinity; and that the command must not only take the sanitary precautions outlined to protect themselves now, but the other organizations of the zone of the advance, those of the lines of commuications, and the civil inhabitants of the territory occupied are entitled to consideration. These sanitary measures are not only directed to prevention of production of insects, but also to the prevention of carriage of disease by them.

Many insects are merely mechanical carriers of disease, and a fly, in being, may dabble in the seductive delights of typhoid, cholera or dysentery stool, and furnish a company with all of the invalid-

ism it wants; or transfer glanders, tetanus, or what not in the way of disease, from soil or sore, to the healing abrasion on the back of your hand; or the flooded latrine trenches may spill their uncovered contents into the first available stream, and give not only typhoid to the unvaccinated, but its first cousin, paratyphoid, to the first uninoculated individual who drinks from the brook.

Divisional Sanitary Units

The service of ambulance companies has been outlined in general for the camp and march in previous lectures. The organizations camp together in the permanent, semi-permanent, and march camps, where possible, unless they are separated for some special duty, when those organizations so separate, as with an advance flank or rear guard, camp in advance of the trains of the organization to which attached. This on account of the fact that the nature of this detachment ordinarily implies likelihood of hostile contact. Whatever the nature of the duty, they are camped in a position to give them ready access to the front and rear, in order to facilitate movement on the execution of their duties, usually on a crossroads giving roads that lead to the various sectors of the front. These organizations camp in column of companies, as does artillery, with a depth of 350 yards and a breadth of 100 yards, allowing 25 yards to a company, including intervals. Accessibility to water is essential to these organizations, owing to their considerable number of animals, 78 to each company. Under march or war conditions, the camp of these organizations should be such as to permit their retaining their place in the column, without countermarching.

Aside from the duties of evacuation and transportation of the sick and issue of medical supplies to organizations attached to the combatant troops, these units are in part charged with the procurement of additional supplies from the line of communications and performance of guard duty for field hospitals, besides performing their own camp and stable guard.

Field hospitals in semi-permanent camps have little to do with the care of the sick, where camp infirmaries and camp hospitals are present. Their duties as outlined in the Manual for the Medical Department, are the temporary care of the disabled, pending evacuation, and they are the nightly collecting points on the march, or in temporary camps, for the individual sick who are unable to continue the march.

Filling them up with disabled would immobilize them and prevent mobility. In any camp, no more field hospital equipment is established than is necessary for the care of the sick, and usually one field hospital or part of a field hospital is detailed for this duty, by roster.

In march camps in campaign, field hospitals ordered to establish, usually do so, taking advantage of such buildings as are available to save time and labor of unpacking tentage, and accumulate, as early as possible, straw bedding and special diet supplies, over the emergency supplies carried in preparation for the daily increment of sick. The field hospital designated for this duty can be marched at the tail of the column, in order to permit, early establishment, and will ordinarily be ready for action by the time the disabled are brought to them, the remaining organizations camp with the sanitary train, guarded by personnel from the ambulance companies. The

field hospitals, as well as the ambulance companies. carry reserve medical stores, and will from time to time issue and refill from those sent up from the advance depot of the Line of Communications.

Lecture VI

SANITARY SERVICE IN COMBAT

Attached Sanitary Troops, Infantry, Cavalry, Artillery, Engineers, Signal Corps Sanitary Train

THE duties of Sanitary Troops in combat are:—

1. Care of the wounded by application of appropriate measures for their temporary treatment.

2. The collection and evacuation of the wounded with care and distribution to the various establishments according to the gravity of their wounds and probable duration of disability.

3. The separation of the disabled from the non-disabled and action to return the non-disabled to duty.

4. The preparation of records of dead and wounded.

5. The management of the Sanitary Service and the renewal of sanitary material and personnel expended.

6. The examination and supervision of the interment of the dead and the sanitary policing of the battlefield.

The necessity for such a service is essential to preserve morale among the combatant troops and to prevent depletion of the firing line by detachment for care of the wounded. F. S. R. 344 forbids combatants, unless duly authorized, to take or accompany sick or wounded to the rear, and, in the light of the experiences of the Russians in Manchuria, where

the firing lines were depleted by such action, a provision of this kind is necessary. Fischer quotes Von Tetlau as saying: "Of the Russians, seriously wounded were carried by four unwounded soldiers and followed by two men as companions; each one who was wounded in the leg supported by two well comrades, while a third carried the arms. The companions never were in a hurry to return to their organizations." "Help should seek the wounded, not the wounded help, else we open the door wide for the (un)wounded to loaf around."

Attached Sanitary Troops

Our tables of organization provide four medical officers, four noncommissioned officers and twenty-nine privates of the sanitary troops for a regiment of infantry. The same number with a regiment of cavalry; and three to four officers, three to four noncommissioned officers and twenty to twenty-nine privates with a regiment of artillery, when at maximum strength.

The combat equipment of these organizations when serving with a brigade or division having mobile sanitary units, consits of 1 field desk, 1 box reserve dressings, 1 medical and surgical chest, 1 bucket, G. I., 1 axe, 1 tent fly, 2 lanterns, and the personal equipment of the men and officers, besides litters and boxes of surgical dressings carried in the combat wagons.

The contents of the field desk consist of stationery, blank forms, and books. As it is doubtful that all of the space will be used for these articles, the canny medical officer may store dry medicines or dressings in reserve. This field desk is carried on the regimental headquarters wagon. The remaining articles except those of the personal

equipment are carried on the pack mule for use with the regimental aid station.

This gives with each regiment, in addition to one 1st aid packet on the person of each individual, an amount sufficient for first aid of a regiment acting in conjunction with mobile sanitary units, and sufficient for 20% loss.

Should the regiment be acting independently, it will have available the contents of the regimental hospital equipment, which will be pushed forward as a combined dressing station, field hospital. The medical, surgical and sterilizer chests and food boxes and cases will give much additional dressings, supplies and restoratives, together with necessary medicines, instruments, appliances, towels and bedding for 12 patients.

Independent battalions such as Signal Corps carry the aid station equipment. Cavalry and artillery, having a smaller sanitary personnel, do not have so much personal equipment and dressings, but have a sufficient equipment for their necessities.

Of means for transportation of patients, the regimental sanitary personnel has available litters, in amount according to the organization, carried by the sanitary personnel attached to each battalion with the headquarters section, and one litter belonging to each company carried in the combat wagons or all carried in the combat wagons.

In the infantry, there will be eventually available, eight litter squads of the Medical Department personnel and fourteen litter squads of the band, provided the band is kept to full strength. Usually this is so with an infantry regiment. The cavalry will have at best, only four litter squads from the Medical Department troops, and the artillery six, with only 6 or 7 company litters. If the regiment is

acting alone it will have in addition, 4 ambulances and two field wagons attached to the sanitary troops. The ambulances can carry four recumbents and one sitting or nine sitting each, and the wagons four or five moderately wounded in the usual proportions of recumbents to sitting 3 to 5; the wheeled transportation can carry in an infantry regiment on the sanitary, combat, and ration and baggage sections, field and combat trains, 12 recumbents and 100 sitting cases, these latter including the-able-to-walk, to the field hospitals.

Field Wagons

	Combat		Baggage	Rations	Equals
Regiment, Infantry,	11		5	11	27
Cavalry, ----------	8		13	16	37
Artillery, ----------	85	carriages	3	18	plenty

As noted in the Sanitary Service of the March, the position of the surgeon, the battalion sanitary personnel, and the headquarters section of the sanitary personnel was that which placed them in a satisfactory situation with respect to the command, either for the service of the march or combat.

In preparation for combat the surgeon, up with the commanding officer, has already traversed the ground to tohe rear of the probable position, and is informed as to the terrain and, with the commanding officer will examine the terrain to the front with a view of determining the probable positions of the combatant troops and probable covered lines of communications to the rear as representing the course of drift of the wounded. He will be informed of the

plans of the regimental commander and in consideration of these plans will make recommendations as to the probable site or action of the regimental aid station. Such action must be dependent upon the type of action to occur. If it be a planned attack, the surgeon will select a tentative site for an aid station and hold his equipment in readiness, pending the development of the action. This organization will not be needed for some time and should not be established until there is a definite use for it. Changes of disposition may require disestablishment and change of position, a thing not difficult, unobjectionable when necessary, but nevertheless undesirable when required through the fault of too early establishment. A planned defense permits early establishment and notification of the command as to the position of the aid station in combat orders.

Rencontre requires, for the aid station and the mobile establishments, delay in establishment until the positions of the troops and the conditions of the action are determined. Usually demands of wounded for establishment will not be immediate.

Delaying actions require the earliest establishment and evacuation possible, in order to clear the wounded before the retreat. Transportation, if available, should be pushed up as close as practicable. Consider using combat wagons where advance guard actions follow the lines of a planned attack.

The three essentials in the treatment of the wounded in modern warfare are:—

1. The prompt application of a sterile antiseptic dressing in such a manner as to prevent contact of matter to the wound surface other than the sterilized dressings and to maintain these dressings on the wound to prevent this.

2. To describe the wound and manner of dressing on the diagnosis tag, attached to the person of the wounded man in such a way that redressing or interference with the first dressing will not be required unless the diagnosis tag justifies or requires such action, or special conditions make this necessary.

3. To evacuate and treat the sick in a manner to conserve their strength to the greatest possible extent, with the least movement to the rear possible according to their condition.

The necessity for prompt dressing in a skillful manner lies in the strong probability that nature may care for a moderate amount of infective material carried into the wound by the wounding agent, but that it may succumb to a larger amount. The sterile cotton dressings act as a filter to exclude infectious agents and yet permit the wound to drain and dry while the antiseptics with which the dressings are treated form an unfavorable medium for the growth of noxious bacteria.

In addition to prevention of infection, proper dressing diminishes loss of strength through hemorrhage, and produces mental rest.

The use of morphine on the field is a great aid in securing freedom from pain and worry and decreasing hemorrhage and shock particularly when it may be impossible to secure prompt evacuation. The conditions of action frequently do not permit evacuation from the field until cessation of firing or intervention of darkness.

Tagging is necessary: (a) To prevent interference with the wound when properly dressed on account of the fact that clotting of blood and serum in contact with the antiseptic in the dressing forms an antiseptic seal over the wound, and to reopen it

breaks this seal and exposes the injury to additional chance of infection and hemorrhage and may interfere with reparative processes already started. Blood soaked dressings in themselves are not cause for change of dressing. (b) To conserve time and energy and facilitate transportation and record. The tag bears the name, rank, organization, diagnosis, class of case, walking, sitting or recumbent, non-transportable — treatment, disposition. Date and name of person caring for him. They will be affixed to sick, wounded, and dead. The duplicate retained in the book, serves as a record for casualty lists, etc., and the original, as a means of identification record, record of treatment, movement, etc., prior to admission to the field hospital, the first organization of permanent regulation record, and serves as a pass to the rear. By this means, control of the slightly wounded can be had and kept away from a dressing station and field hospitals, and loafing of wounded and malingering can be to a certain extent prevented.

During the Russo-Japanese War this loafing and malingering among the Russian wounded, was most pronounced. With the diagnosis tag properly made out, receiving departments of sanitary organizations may see at a glance the condition of the patient and make proper disposition of him without delay and danger of reexamination, and change of dressing. Tags are affixed by the n. c. o. or officer of the sanitary service who comes in contact with the case, where possible.

In combat of infantry the battalion sanitary personnel will accompany the battalion, using their personal equipment; where time permits before going into action, they will draw additional dressings and carry them in their haversacks. As the action

will require the medical officers to be dismounted, all orderlies or substitutes will depart to the aid station with medical officers' mounts and will be available for dressers or messengers.

The noncommissioned officers will serve as assistants to the medical officer and record and dress cases.

The band in campaign will ordinarily carry light instruments and under authority of the regimental commander may when marching in the presence of the enemy habitually march with the sanitary troops, as litter bearers, or, at the beginning of an engagement, be reported to the surgeon. They should have been well trained in first aid and duties of litter bearers, and will be supplied with company litters from the combat wagons and used by the surgeon, as a bearer section, to be sent wherever lies the greatest need for their services.

The sanitary troops (in extended order) will be disposed of in such a manner that one private shall cover the rear of each company in the best manner possible, exposure and first aid considered, with orders that they will keep good observation and contact with the organization to which attached (and if possible contact with the aid station), whatever the movements of the battalion. If a company is detached, the private covering that company, must continue to do so. While it is frequently impossible to render first aid to all that fall it is essential that sanitary personnel be in contact with all troops for the sake of morale, as well as actual service. It is not intended that immediate dressing or removal be made in the face of a dangerous fire, because few wounded need immediate attention so badly that the few individuals of the sanitary service should be sacrificed in the individual case, when many more

valuable, the lesser wounded will need their service. So rare is the case that needs immediate service to preserve life that of 1440 casualties at Santiago, none such existed. The only type of case that requires such attention is possibly a hemorrhage from a large vessel, and ordinarily, first aid, such as can be given on the firing line, is of little avail in these cases. Remember, a desperately wounded case, while he should have all of the attention that can be given him, requires and should have the least interference and movement possible, and in view of results is not as valuable an asset to an army as one of lesser gravity. Under the ordinary conditions of combat the sanitary troops with the firing line do not and cannot keep up with the line, but keep it under observation, under cover, and taking advantage of cover, dress all cases and remove them to depressions or behind obstacles that would give them protection from fire. Here the wounded of the battalion will be collected at a point which affords communication to the rear, permitting early evacuation by the litter squads. It will be infrequent that conditions will permit early collection.

The position of a battalion surgeon will ordinarily be at the rear of the center or inner flank of the battalion in order to place him on the line of drift or communication to the rear, and as close up as fire and terrain permit. He will notify the enlisted sanitary personnel, covering the companies, of his position and keep in touch with them and the battalion. Should the battalion be considerably detached from the site of the aid station, he will choose a collecting point, permitting movement from the front and evacuation to the rear, where he will collect the transport cases. Slightly wounded cases will either be returned to their units or tagged and ordered to pro-

ceed through the regimental aid station to the station for slightly wounded if such exists. After engagement, he will complete the evacuation of the wounded, assist in the sanitary police of the field and assist in clearing the aid station.

The surgeon, as soon as the command is committed to a position or the number of wounded warrant such action, will, under authority of the commanding officer, choose a site for the establishment of the aid station. This is usually established as near to the firing line as the conditions of cover for movement under fire toward the front and rear, line of drift of the wounded, shelter and supply of wood and water permit. Given cover accessibility, and proper lines of drift of wounded, under protection from fire, the aid station will be pushed as far forward as is possible, so long as it will not, probably, be involved in the movements of the line. The consideration of shelter, wood and water supply near at hand, while desirable, is not absolutely necessary, as the first requirement, if in buildinigs or structures of similar nature, frequently draws hostile fire, and wood and water can be brought up. Given other considerations, the aid station should cover the center in order to equalize and lessen distances. The regimental aid station is little more than a geographical rendezvous for wounded, where they can be collected for record, dressed, possibly fed, sorted, and sent to the rear or front. The knowledge of possibility of food and care will bring the wounded here and permit organization of the return of the fit, and direction of movements of ambulants, and evacuation of transport cases.

The commanding officer, combatant troops, of the battalion and the sanitary troops with them will be notified of the site of the aid station by the com-

manding officer. The surgeon also will notify the battalion surgeon of the site, the battalion surgeon will notify the combatants and his personnel. Contact will be gotten with the divisional sanitary units at as early a time as possible, and the dressing station detachments and chief surgeon notified of site and conditions.

When necessity occurs, and not before, the equipment will be brought up, the packs unloaded, and the tent-fly erected, if necessary. Marks, (peeled twigs, blazes or bandages on trees or posts) will be set up, showing direction to aid station: larger marks are only advisable where they cannot be observed by the enemy, as they have usually drawn fire both in the Russo-Japanese and European War.

The aid station is organized into a receiving, dressing, feeding, and dispatching section. The bearers of the band are used in evacuating from the battalions under the band n. c. o's., and noncommissioned officers and privates of the aid station party are used for technical work. All wounded passing through the aid station are recorded and those needing it are tagged. The ambulants are directed to the rear in parties, under charge of a wounded officer or n. c. o., the slightly wounded to the appropriate station—and those very lightly wounded, who do not require movement to the rear, utilized or returned to their organizations, usually escorted by the band litter bearers (armed). Here, as on the firing line, the least amount of surgical work compatible with saving life is done. The greatest attention is paid to first aid, collection, sorting, evacuation and organization of the wounded. Advantage will be taken of all adventitious materials or aids in this work. Should movement of the com-

mand require it, the station may be reestablished where necessary, leaving the collected disabled in charge of sufficient personnel to care for them until taken over by the organizations at the rear. The personnel with a battalion not in action, in reserve, will be utilized to the utmost and all personnel brought back as a reinforcement, as they clear their front. The pack mule may be sent to the rear to renew supplies during an action; and, after the action, must take on supplies to give full complement, according to the supply table.

On conclusion of the engagement, or during a lull in firing, or after nightfall the bulk of collection and evacuation will take place. The extended range and rapid fire action of modern arms will ordinarily prevent succor of the wounded in the zone of fire, and overshots the use of wheeled transport near the rear of the firing line. Here all removals must be made by hand or litter. The regimental sanitary troops, with band auxiliary, will make a search of their sections, collecting the wounded, and tagging the dead alike. If this is at the conclusion of the action, the sanitary troops will be accompanied by combatant details which will take over the dead, examined and tagged and listed, by the sanitary personnel, for burial; and in cases where necessary, assist the sanitary personnel in the collection of the wounded.

In case the aid station has cleared in its location at the rear, it will be moved up and reestablished on the field and avoid long hauls. When the wounded are collected and cleared from the aid stations by the bearers or transport of the ambulance company, a part of the regimental personnel may be withdrawn to assist at the dressing stations under orders from the division surgeon.

The final police of the regimental section of the battlefield, after removal of wounded, will proceed under the advice of the local medical officer in connection with the supervision of the sanitary inspector of the division.

In trench warfare modern practice shows the best results where, like in the planned defense, the attached sanitary troops are in the trenches with the combatants with the aid equipment and party in a special communicating trench, in such a manner as to permit access to all parts of the line. Here under the protection of bomb-proofs and trenches, most satisfactory work can be done and the equipment can be much more elaborate and complete. Evacuation to the rear is ordinarily made in this case under cover of darkness. The possibility of good roads under these conditions makes rapid evacuation comparatively easy and swift, and can be direct from the firing line to a field, or even an evacuation hospital, or train or boat.

Artillery aid stations and those of cavalry dismounted, conform to the action of those of infantry, except that care must be taken in the case of the aid station of artillery, to establish, rather on the flank and away from the reserve, as this will ordinarily be searched for in artillery combat, and the wounded will be needlessly exposed. The sanitary troops with a cavalry regiment will ordinarily establish little, and devote most of their attention to accompanying the command, leaving their wounded with detached personnel to be taken over by the divisional organizations. As the many small engagements of cavalry preceding and during general action will produce many scattered casualties over a wide area, and the aid party will be of little use, it will usually be advisable to keep the squadron

units to full strength. Owing to the necessity of frequent changes of position and plan of action, the regimental surgeon serving with the mounted organization as well as those on foot, will do well to have a mounted agent with the regimental headquarters when he is absent at the aid stations or elsewhere, in order to keep informed as to the changes in situation.

The Ambulance Company

The personnel of the ambulance company at maximum strength, consists of officers, 5; enlisted, 119-150; ambulances, 12.

The ambulance company for duty assignment is divided into four detachments. The bearer detachment consisting of twenty litter squads, the dressing station party, the ambulance detachment, and the wagon detachment.

The technical equipment consists of the personal medical equipment, the equipment in the packs, and dressing station wagon, and the food and dressing boxes of the ambulances.

The total of dressings, etc., for combat care of wounded will give dressings for approximately 1800 cases and 4000 cups or dishes of restorative stimulating food, such as blanc mange, beef tea, soup, milk punch, tea, malted milk, oatmeal, porridge or gruel, and chocolate. That is sufficient for 10% of casualties, not considering the dressings put on by the attached units or the equipment of the other ambulance companies.

As given in former lectures the ambulance companies are under the direct control of the Director of Ambulance Companies and on release of this portion of the sanitary train from the control of the commander of trains, will be managed by him under

orders of the chief of staff, or surgeon, during and after combat. The activities of the director and the ambulance companies cover the entire zone, between the firing line to the field hospital. Under the orders or authority of the chief surgeon, he will establish dressing stations, change their sites and make proper arrangements for the collection and transportation of the wounded.

The four detachments of the ambulance company have usually different sections on the field for their work. The bearer detachments collect the wounded from the regimental aid stations, or under favorable conditions from the field, and transport them to the ambulance head, if conditions of terrain or action permit use of wheeled transportation in advance of the site of the dressing station. The dressing station party remains with the dressing station at its site and is reinforced as may be necessary from the personnel of the bearer section.

The ambulance detachment transports the wounded from as far forward toward the actual field, as is possible, terrain and fire considered, to the dressing station or field hospital. The wagon detachment detaches one wagon with the equipment and supply reserve of the dressing station and sends it as far forward toward the dressing station as conditions permit. The other field wagons ordinarily remain back near the divisional field trains when the other detachments go forward.

The time and place of establishment of the dressing station will be determined by the conditions of the action and the terrain; for a planned defense, they may be established early and the sites stated in the combat order; but for offensive, or rencontre actions, establishment will not be done until the positions of the troops, the drift of the wounded

and the type of action determines the necessity. Too early establishment will, in case of an advance, leave the station without function, and require advance and reestablishment, or involve it in the line of fire or movement of troops, in case of rectification of lines.

The regimental sanitary personnel will be able to handle the situation at the front for a considerable time and the wounded who come back early will ordinarily be ambulants, who have no need of the dressing station. The transport cases will hardly be back to the aid station during the first hour of the engagement. Should the lines advance materially, it will be well to advance the station to the wounded and avoid littering the patients any farther than necessary.

Littering, at best, is slow and exhausting work, and every effort must be made to abridge distance. In the eariler part of the Russo-Japanese War, much difficulty of transport arose, through the tendency to too early establishment. In delaying actions with a planned defense and subsequent retreats, early establishment and evacuation is necessary and reinforcement of the sanitary personnel is desirable and necessary, particularly with bearer and ambulance detachments. Ordinarily the time for establishment will come when the advance has ceased, and the regimental aid stations have more wounded than they can care for.

The division surgeon will determine where and how many stations will be opened and will consider in this decision the field of greatest casualties and probability of further action as to location and number establishing: he may have them establish individually or combine and, if not pressed, will hold one or more in reserve to reinforce other stations,

or to place in points of future casualty, when the proper time arrives.

The factors to be considered in the selection of a site for the dressing station, given necessity and consistency as to battle plan and actions, are:—

1. Location near a practicable route of evacuation from the front to the rear, usually on some well marked line of approach.

2. Possibility of cover at site of station from aimed and overshot fire.

3. Sufficient proximity to aid stations to decrease transport distance, and, yet, not to include station in minor changes in lines.

4. Proximity to shelter, wood, water; buildings as shelter have the disadvantage of attracting artillery fire and are therefore not an unmixed blessing, and wood and water may be transported if necessary; but frequently the same inequality of ground which affords cover and covered communication to the front, will give wood and water.

The necessity for the establishment, on a practicable route is obvious and, other things being equal, should contemplate a point which will intersect a line of probable drift of wounded, who will, if fire and cover permit, usually, follow the line by which they approach the field—the only route known to them—and will ordinarily follow ravines or the lower slopes of hills, in order to get advantage of the cover afforded. Interception of these ambulants is necessary in order to give them proper direction and care, at a time when the station is relatively idle as they usually precede transport cases, and can be pushed back to the station for slightly wounded on foot, or to the field hospital, as their condition requires.

Necessity requires that the dressing station be as close up as possible: a distance beyond infantry or artillery fire would render the establishment useless.

Examination of almost any field will show sufficient cover to permit movement forward of the personnel and equipment with pack transportation, which may subsenquently be sent back for supplies.

On establishment, the bearer section will be sent forward to establish contact with the aid stations, ordinarily dividing into two sections of ten litters each, with a definite sector assigned, by subdivision of the ambulance company sector assigned by the director.

The bearer sections will place Red Cross guidons, bandages, or peeled twigs, as route markers, indicating the direction of the dressing station, while moving forward and will notify all regimental personnel of its location. The commanding officer will report time and place of establishment to the director.

The dressing station will estabish the following departments: Receiving, dispatching, slightly and seriously wounded, dressing and dispensing, feeding and morgue. All patients received will be examined, listed, tagged, if necessary sorted, distributed or dressed, fed and dispatched to the rear or front. The slighly wounded, requiring evacuation, will be arranged in squads, in charge of a wounded officer or n. c. o., and, after feeding, marched to the station for slightly wounded; those requiring movement to the front turned over to a provost officer.

The ambulant, seriously wounded, will be sent to the field hospital on foot, convoyed by ambulances loaded with transport cases; and the transport cases after being grouped as sitting and recumbents, loaded as such by the dispatching section.

No operations other than those immediately necessary to save life will be done, such as tying or clamping an artery, or opening the trachea; and such operations will be rare. Feeding will be limited to stimulating and restorative food and drinks, and has been found advantageous, not only from a standpoint of pure medicine, but also as a means of securing attendance of the slightly wounded, who otherwise may straggle without control. Possibility of food and aid brought many to the dressing stations in the Balkan and Manchurian Wars.

For purpose of bringing up reserve supplies and collecting local comforts, such as straw, hay, etc., the reserve wagon will be brought up if possible and the ambulance detachment will establish a head at, or to the front of the dressing station, where roads and cover permits, in order to decrease litter haulage.

Every effort should be made to prevent overcrowding of dressing stations, and to facilitate evacuation. Additional transportation, field wagons and local transport, may be used.

Neither the dressing station nor the ambulance detachment must be held back on account of casual fire, but must advance from cover to cover until it reaches a relatively protected zone. Movement in column will frequently draw fire, as at 600 yards, with present system of marking, an ambulance cannot be differentiated from a field wagon, so that movements in evacuation can be frequently best accomplished by single wagons. The capacity of a dressing station in material has been given, 1500 to 2000 cases, the capacity of the personnel is given as from 15 to 20 dressings, per surgeon, per hour, in fair weather. Although the Japanese state that at Mukden, two surgeons and two assistants placed 25

to 30 dressings per hour and could have done 30 to 40 in the same time, in summer. Fischer quotes Schaefer as saying that it was not unusual for a surgeon to do 24 dressings in an hour.

With two medical officers, this would give from 30 to 40, per hour, a considerable number of wounded, more than half, will be properly tagged and dressed, and these will not need dressing, giving a capacity of 60-80 per hour to the dressing station unreinforced. If additional help is necessary in the early stages of the action, it must come from the medical officers of the bearer detachment, who can double the capacity of the dressings; and if more is needed, such can come from the personnel of the field hospitals if they do not go into action, and, after the aid stations are cleared can come from them: and the chief surgeon may direct such reinforcement.

After fire has ceased and the stations cleared, the bearer detachment must search for the wounded. With the combatant forces in position, this cannot be done until after nightfall and then under difficulties. The Manchurian War showed that moonlight permitted view of the searchers, and on dark nights, artificial light drew fire. While on the western front in the pan European War, the close proximity of the lines, renders this almost impossible, so much so that many wounded have lain for days without succor. Systematic search will be made where possible, by assignment of sectors, and the wounded will be evacuated to the ambulances, which can usually be brought up under the conditions that render this collection possible.

After clearing the wounded to the field hospitals, the director of ambulance companies will usually receive orders to pack. If help is needed at the field

hospitals, personnel will be assigned from the ambulance companies for this purpose; and the ambulance companies will bivouac on the field with the command or camp with the field hospitals, as directed.

The work of these organizations, both for men and animals is exceedingly arduous and without regard to hours. Under conditions of combat and after, little rest can be given. Great care must be taken to secure the most economical use of these organizations, in order to prevent exhaustion.

Lecture VII

SANITARY SERVICE IN COMBAT

Station for Slightly Wounded—Field Hospital Companies, Advance Group, Line or Communications

The Station for Slightly Wounded

THIS is an establishment of our sanitary service created as a result of experience gained in the Civil War and emphasized by observations during the Russo-Japanese War. It has been adopted by the Austrians, British, and Germans, following our example.

This station is established for the purpose of diverting the ambulant slightly wounded from the field hospitals, and evacuation hospitals. If they have been given a definitive dressing by the regiment personnel these wounded can be sent directly to the slightly wounded station, without interfering with or encumbering the service of the dressing stations and field hospitals.

The cases sent to these stations are the slightly wounded ambulant cases, who are capable of marching back to the railhead or if necessary to the convalescent camps or establishments for slightly wounded in the advance group of the L of C, on their own feet. Such cases comprise wounds of the upper extremities, superficial wounds of the trunk, head, etc., which will prevent full participation in active service, but will, ordinarily, be able to care for themselves and result in early return to their organizations. This class of cases would fill the space re-

quired for care of the more seriously wounded and add to the burden of the transportation, if cared for by the other institutions, and straggle, and be lost from control, and materially delay their recovery and restitution to their organization, if turned loose to make their way to the rear uncontrolled. Genuine slightly wounded requiring control by this station amount to some 12% of all casualties, and these, together with a considerable number of cases of wounds so slight that they should be returned to their organizations, and malingerers formed the contingent, who during our war of the rebellion, and the Russo-Japanese War, particularly in the Russian service, the bulk of the straggling wounded who were annoying; as they were not only disorderly, but caused material depletion of the total of rifles. Such cases were seized upon by enthusiastic citizens in our Civil War, and in the early days in the French service of the pan-European War and taken, unrecorded, to the rear in great number. They were lost to the services for considerable periods of time and contributed much to permanent absenteeism.

The station for slightly wounded assists much in the sorting process and may catch a considerable number of more serious cases, which can be detained and sent with proper transportation to the field hospitals.

Under proper administration of the sanitary service no wounded man should be permitted to move farther to the rear than the field hospitals or aid stations, when not in custody of the sanitary service; and no wounded man should be permitted to move in the zone in front of the field hospitals and aid station untagged or unattended. Such requirement will ensure control of wounded and give the best results in economy of service. Malingerers and tri-

vial cases will not find encouragement or license, and will remain with their organizations.

The routine in the past for the battle malingerer has been to avoid contact with the regimental sanitary personnel, by whom he is generally known, by skulking, and by attaching himself to some non-sanitary unit by affecting slight wounds, gain the rear. The requirement of constant sorting out and control will make this relatively impossible.

The personnel of the station for slightly wounded will ordinarily consist of a medical officer, a non-commissioned officer, and six or eight men of the sanitary contingent and should include a squad of the military police for the control of the trivially wounded and malingerers, and their restitution to their organizations.

The equipment of the station for slightly wounded will ordinarily consist of dressings, medicines, food, and cooking utensils, in addition to that of the personnel. Shelter will not, usually, be provided, but advantage will be taken of buildings near the point for establishment. All that is needed at this point is sufficient personnel to record, examine, readjust dressings, and provide stimulants and restorative food, as the cases will have been dressed before arrival. Some shelter should be provided with straw or improvised bedding, as some cases will become exhausted through shock and loss of blood or serious cases may be picked up—which will require subsequent removal.

The personnel and material will come from the ambulance company or more commonly from the field hospitals as these organizations will usually be more or less idle at the time of establishment and hardly greatly occupied until the necessity for the unit has ceased—when the equipment and personnel

withdrawn can most readily join these organizations, as the distance of these organizations from the front is somewhat similar. The camp infirmary equipment will be available.

The site for the station for slightly wounded should be well to the rear on the line of drift of wounded, well out of range of direct fire, preferably at a fork or convergence of roads from the flank and center, near some easily recognizable object which can be mentioned as a guide to its location. For purpose of recognition of its position this object as a church, school, monument, or natural formation should be selected, where possible, from those passed by the command on advance to the front. A most satisfactory distance from the firing line is one of some $2\frac{1}{2}$ or 3 miles, with the understanding that the slightly wounded station should be in advance and well removed from the site of the field hospitals in order to divert the slightly wounded from them.

Owing to the fact that these stations are to be established well to the rear and their ephemeral nature, a site can be chosen early and their location announced in the combat order. Ordinarily only one S. W. Station is established for a division and none for units of lesser size; but where natural or artificial conditions render it likely that the entire area cannot be drained by one such station more may be established.

The station consists of a receiving and forwarding section, a dressing and feeding section. The wounded are examined, listed, sorted according to their condition, and tagged if necessary, and fed; some dressings may need renewal and some exhausted or hemorrhage cases may require rest or

hospital treatment. Of course these will be detained.

Those to be sent to the L of C will be arranged in detachments of 30 or 40 and placed under charge of slightly wounded officers or noncommissioned officers who will be given orders, where possible, with a list of men in his charge, giving the route of march. This route should coincide with a line of evacuation of wounded so that these detachments may be convoyed or supported by wheeled convoys of wounded in order to give care to the exhausted.

The C. O. of the S. W. detachments should be directed to leave any exhausted cases under shelter on the route and notify the nearest sanitary echelon of their condition and position. If the road be long, arrangements will have been made for rest and refreshment stations, which will be necessary for both the S. W. and the transport cases.

Field Hospital Companies belong to the divisional sanitary train.

The field hospital companies are controlled by a Director of Field Hospitals whose duties correspond to those of the director of ambulance companies and the field hospitals, moved, established, and closed by orders of the chief of staff or chief surgeon usually through the director, following the methods outlined for ambuance companies.

The purpose of the field hospital is to provide temporary shelter and care for the seriously wounded or sick in camp and, during and after combat, pending their evacuation to the rear. Their capacity has been changed from shelter (tent) and bedding for 108 to 216 patients, giving for a division 864 beds and they carry technical equipment for many more patients provided shelter and bedding material can be secured from local sources.

The personnel consist of 6 medical officers, and 80 enlisted men. Transportation, 7 field wagons, or 11 trucks.

The equipment of our field hospital differs from that of the European armies in the fact that it provides more tentage and bedding equipment, and medical and surgical equipment. The European armies depending upon adventitious shelter, bedding and household equipment as a whole or in part; and in that part of the functions of the field hospital are covered in the dressing stations of the sanitary company or "ambulance" and part by the clearing or evacuation hospital.

A recent reorganization of the French service found neesssary during the present war, has recognized the necessity of this organization, which they only had as did the English in the shelter section of the "field ambulance" by introducing a new unit—the surgical operating hospital, a motor transport affair of one hundred bed capacity, with a special motor operating room. One of these to an army corps. The functions of this organization are covered by the equipment of our field hospitals. Although present practice and opinion in America and abroad questions the advisability of performing any but the most immediate necessary operations, at a point in front of the more or less fixed hospitals; because not only must there be little or no pressure of wounded when these are done, but also cases of this character require post operative rest, which cannot be secured in a mobile unit.

The field hospital, packed, is as mobile as its method of transportation, field wagons, or motor trucks, permits.

Not counting the desperately wounded who cannot endure extended transportation, and will conse-

quently, not be taken to the field hospitals, unless they establish on the field, the field hospitals may be expected to care for about 60% of the total casualties, a high percentage of which must be bedded until evacuation: the bedding capacity of the field hospitals as given above is 864 patients and capable of extension, depending on local improvised shelter and bedding, straw with personal blankets collected on the field.

For an infantry division this will give a capacity to accommodate a total casualty of roughly 10%. The average daily battle casualties as shown in the Franco-Prussian War was for the Germans 4.7% and in the Manchurian for the Russians 1.7% and the Japanese 2%. The high losses shown in some battles in Manchuria of as high as 68% for some organizations were distributed over several days; although one division lost 30% in a single day. No sanitary service can be equipped to handle such a high daily loss and, in view of the average losses given and possibility of reinforcement by organizations from divisions less hardly pressed, this capacity of 10% carries a fairly high factor of safety.

In combat, field hospitals will establish at positions and times selected by the division commander, or surgeon, in the absence of instructions. In an attack they will not be established until the advance has ceased or the numbers of wounded at the dressing stations justify such action. In a planned defense they may be established or at least in position of readiness early, to establish when required. In a meeting engagement, the field hospitals will be halted off the road until the course of action is determined.

In preparation for combat the field hospitals will be assembled and, when establishment is justi-

fied, one or more will be sent forward to cover the lines of evacuation from the various sectors, those remaining unestablished to be held in reserve and fed in either position, as a reinforcement of other hospitals, or independently.

The field hospital can be established in about one hour, and if clear, packed in one and one half hours; and, filled with wounded, will require three ambulance companies for its evacuation and a much longer time to dispose of the wounded and pack. Particular care must be taken to avoid establishment too early or in an unsuitable position, because for use for the day after establishment, it is practically immobile.

The site of establishment should be some three or five miles to the rear; protected as much as possible from directed artillery fire; on good roads, to the front and rear; and near the probable route of sanitary evacuation, which will place it away from the route to the front carrying ammunition and reinforcements. An ample supply of good water is necessary, and it should be located, where possible, near suitable buildings; these can be utilized as shelter in place of or in addition to the tentage carried; in addition to shelter, the vicinity should also afford household conveniences, straw and wood. In selecting a location for a field hospital, while due regard should be given to the proximity of permanent objects, as a means of locating it; nevertheless the buildings, or site occupied by it, should not be capable of being seen from the front, owing to the tendency of hostile artillery to fire on aggregations of buildings, men or troops. Experience in the pan-European War would lead to the assumption that the Red Cross flag is not easily recognized, as such, at distances given, or that its protection has been

disregarded. When establishing with adventitious shelter much of the heavy equipment of the field hospitals, will not be unpacked, and the personnel will be employed in collecting and improvising local equipment and materials for hospital use.

The various routes to the field hospitals will be marked by day and night, by guidons, signs, or lanterns. The same care here is not necessary, as in the dressing stations to avoid attracting hostile attention, by guide flags, as the distance is too great to permit recognition of ordinary sized flags.

Given other conditions as satisfactory, the field hospitals will be located so as to cover the field of greatest casualty, and, should the enemy retire, they will be located near the dressing stations or on the field itself. Where field hospitals are ordered up to replace a dressing station, they will transfer the equipment, by exchange, and take over the wounded, releasing this part of the ambulance company for further duty elsewhere.

The positions of the field hospitals on the march with a division, when hostile contact is expected, lend ease to their establishment, or position in readiness, following deployment of the division. Their position at the rear of the main body, places them some five miles to the rear of the head of the main body, and should this deploy on a position taken up by the advance guard movement forward at ordinary gaits, could put the field hospitals near their probable position within an hour and half after the order for deployment is given, rather too early for a position in readiness.

In order to clear the road, however, and put them near where will be their probable location, plans of the division commander, roads and terrain, and probable field of casualties and fire considered,

the field hospitals will be moved forward, or assembled at a convenient point on a probable route of evacuation.

The director will inform himself of conditions of shelter, supply, and communication in the rear of the sector covered by the division, and, as soon as he receives information as to the sites of the field hospitals, will designate the organizations and arrange for use of shelter and supplies at hand. He will get in touch with the Director of Ambulance Companies and arrange for co-ordinating his service with that of the transport. The division surgeon will be notified of the time of establishment as it occurs.

The field hospital will establish: A receiving and forwarding, slightly wounded (sitting), a seriously wounded (bed), an operating, dispensary, kitchen, morgue and transportation department.

The receiving and forwarding section will record, sort, and assign patients on receipt and dispatch through the transport section, moving the received patients to the wards and operating section, according to their classification, or turn them over to the transport column for evacuation. The operating section will, as stated before, avoid operations, which can be delayed until more suitable environments are available, and confine itself to those immediately necessary to save life, or to prepare patient for evacuation. Patients will be cleared from the field hospitals established, ordinarily, by transfer to line of communications columns, transporting them to evacuation hospitals on trains or water transportation or, in default of these lines of communications, to other field hospitals at the rear, in order to permit release of mobile units to join thier command. Transfer of the disabled is most easily

and satisfactorily made by bringing up evacuation hospital personnel and equipment on wagons or motors and exchanging equipment.

Under conditions where it will be impossible to evacuate all of the wounded in a field hospital (as where one is detailed to care for desperately wounded, in an advance or immobilized with wounded in a retreat), these wounded may be left with suitable personnel and equipment and the remainder move out with the train.

The personnel of the field hospital company will ordinarily furnish the personnel for the station for slightly wounded, and this will usually be designated by the director, from that of a field hospital which will be placed nearest this organization, in order to avoid unnecessary movement of transportation and personnel in establishing and closing. Prior to the time when field hospitals establish or in delaying engagements, when establishment would be inadvisable, the personnel of the field hospital companies may be used to advantage as bearer detachments and reinforcements to the dressing station personnel.

The entire sanitary service of the division must be under the observation and control of the division surgeon, either through the chief of staff, or direct. The service of the regimental sanitary troops will be largely independent, under the control of the regimental commander and surgeon, as to establishment, disestablishment, and interior administration, but, under the regulations a surgeon may be detached for duty at a dressing station and field hospitals, and this will be done by the chief surgeon when necessary, from those organizations least engaged with casualties.

The surgeon will require reports of the time and site of establishment and disestablishment, the number of casualties, etc., in order that he may be able to direct the sanitary service economically and use the regimental and divisional sanitary personnel in the best manner, in the service of dressing and evacuation.

While the station of the division surgeon is with the headquarters of the division, he must exercise general supervision over the entire field, either by use of his assistant and the sanitary inspector, or by leaving one of these in charge of his office, by direct examination of the conditions. The duties of the surgeon lie in administration and direction, and he can best serve the sanitary service, by exercising these functions, rather than by personal care of the wounded. He will co-ordinate the work of the several lines of sanitary aid, in order to procure rapidity and continuity of action, in care and evacuation of the disabled; and, guided by his information of the plan and course of the combat, direct the movement, establishment, and closure, of the organizations within his department.

Orders for this purpose will be issued by the chief of staff upon recommendation of the division surgeon or may be direct by the surgeon, when so authorized by the division commander. It would seem that in stress of a general action, it would be necessary for orders to be issued frequently, direct by the surgeon to the director of ambulance companies and field hospitals in order to avoid damaging delays, and it is probable that the division commander will issue general authority to cover such action. Orders to directors and unit commanders should be so worded, as to cover the general requirements, leaving, as in orders for combatant command-

ers, arrangement of details to the officer of whom the action is expected.

Orders directing establishing or requiring movement to a position in readiness, should carry the phrase "in the vicinity of" or "near a certain point," in order to permit use of natural or artificial features of terrain, shelter, cover, or supply. Orders to directors should be sufficiently broad to permit adaptation of the units on hand to the particular requirements.

Communication and interchange of information will be constantly kept up between the sanitary service of the zone of advance, and the line of communication, in order that the service of the medical supply and evacuation may be most efficient. Arrangement will be made for movement of supplies to the railhead or distributing point and transportation to organization for re-equipment after combat. The advance surgeon will be notified of the location of field hospitals and the distribution and classification of wounded or sick therein, together with conditions of roads, etc., in order that they may be taken over. On the march and in camps preparatory to evacuation, rendezvous points for collection of disabled will be arranged for between the division and advance surgeons and the sanitary service line of communications will be kept informed as to possibility of combat, change of route, presence of epidemics, etc., in order that preparation can be made in advance for unusual conditions.

The police of the battlefields, as stated before will be attended to by the local commander in his sector. Usually the sanitary inspector will be detailed to supervise the sanitation of the field and will be given such sanitary and combatant assistance by local commanders, under orders from the division

commander, as may be necessary. Sites for interment or cremation of men and animals, will be chosen by the sanitary inspector, with due regard to character of soil, drainage, convenience to field, and unlikelihood of disturbance by flood or animals. Action will be taken to procure medical officers and chaplains from the troops of each locality for examination and record of the dead and for appropriate services; and details of a noncommissioned officer or private from each company to assist in recognition, in cases where the identification tag is not found; and burial details for collection and transporting the dead and preparing and conducting the work of interment or cremation. All dead will be recorded on casualty lists with organization and cause of death, and separate trenches prepared for the unknown and the known of our own troops, and for the enemy's. Those of the same organization, will, as much as possible be buried together, and those of our own troops will have their tags buried with them, secured to the neck by a copper wire of generous size. The tags of the enemy, or of the cremated dead, will be retained. Careful note of location and contents of burial trenches will be made to facilitate later removal and recognition. Trenches will be made at least five feet deep, that is bodies should be covered by four feet of earth, in order to prevent escape of gases of decomposition, or exhumation by flood or animals.

All spare earth should be used in mounding trenches, in order to provide for sinking and to give additional covering. As a matter of sentiment and comfort to relatives, it is well to have chaplains of several denominations hold services for the dead, so that each may have the benefit of the particular rites of his church.

Given proper space and soil, burial, if properly conducted, is not objectionable. Ordinarily, in disposition of the dead, the end to be secured is destruction of the putrescible parts of the body, in the least time, without real or sentimental offense. To secure the most rapid decomposition, all clothing covering, or boxing of bodies, should be interdicted and the mass of dead should be supported upon a course of open stone or logs in the bottom of the trench, with a drain for fluids leading to a lower pit. The mass should be topped with a layer of straw or branches, in order to prevent too close contact of the earth which will prevent drainage and rapid disintegration, and lastly mounding with all earth removed. The use of lime, or of other disinfectants on the bodies, or in the grave, prevents rapid disintegration and defeats the purpose of interment, without accomplishing anything that cannot be done by four feet of earth. Properly located and drained trenches will secure this and be relatively safe.

Cremation is usually impracticable on account of difficulty of procuring fuel in sufficient quantities, as one single body on an open pyre will require one third of a cord of wood and at least five hours of attention. While this is an ideal method of disposition of the dead, public sentiment is as yet hardly sufficiently educated to make it justifiable, when interment is practicable; but where fuel is at hand and character of soil or rock formations and lack of space as within a beleaguered area does not permit interment, it is demanded.

The records of the friendly dead will be data for casualty reports. The tags, records, private papers, and possessions of the hostile dead will be turned over to the provost marshal, who will send them to the War Department, for ultimate transmittal to re-

latives or other parties in interest, in the home country.

Service of the Lines of Communications Before, During and After Combat

As stated in former lectures the sanitary service of the lines of communications is divided according to the general organization, into advance, intermediate, and base groups; each with their proper surgeon and equipment of personnel, units, and supply,—with the advance and intermediate groups subordinate to the commander at the base.

The functions of the surgeon of the base group are practically those of a division surgeon, and he is governed by similar regulations. He will have charge of the direction of the transportation, care, distribution, of patients, from the time that they are turned over to the lines of communications until their final disposition; either by transfer to the service of the interior, or return to their organizations; and, for the purpose of caring for them, he will utilize all means of transportation, hospitals, and convalescent camps within his control and, under authority of the commanding officer, lines of communications, will create or establish such other organizations as may be necessary. He will arrange for the supply of sanitary personnel for the lines of communications and to the sanitary troops of the zone of advance, and in order to regulate the flow of these personnel to the front, will establish casual camps for these troops; will establish and control depots for sanitary supplies, which will be issued to the organizations on the lines of communications and the zone of the advance; and will exercise sanitary supervision and control over the area of the

lines of communication, and the country contiguous thereto.

Previous to combat, the surgeon, base group, will be informed as to the probability of action and will direct his subordinates to prepare all of their organization for additional service. All hospitals and institutions will be resupplied and cleared of patients, and mobile and semi-mobile units collected at convenient points in the advance or intermediate groups for service. Advance depots will be supplied and additional units organized as required.

On notification of imminence of action the surgeon advance groups will bring his evacuation hospitals up to the railheads, and if the probable seat of action is well removed from water or railheads, will provide motor or wagon transport for them, so that they can be advanced as necessary. Hospital trains or boats will be brought up to the transportation head and sections of advance supply depots equipped with transportation for movement to the distributing point. The evacuation ambulance company will be reinforced by additional wagon or motor transport and advance well toward the tail of the column in the zone of the advance. Sites and shelter for hospitals and convalescent camps will be selected and plans and equipment for improvisation of trains and boats for patients prepared, in accordance with local conditions. Details for embarkation stations will brought up and rest stations, personnel, and equipment, reinforced; and all measures possible taken to secure rapid and efficient evacuation, care and distribution, of the disabled.

The evacuation ambulance companies of the lines of communications, are allowed normally, on the basis of one to each division, and carry the same personnel and equipment and transportation as do

the ambulance companies, less the four pack mules. They will be used for road evacuation of the disabled from the field hospitals to the evacuation hospitals or rail, or water head. Under normal conditions of daily flow of disabled, and usual road distance, their capacity is ample, but in preparation for combat they must be largely increased as to transportation and personnel, by attachment of enlisted men and wheeled vehicles, with enlisted or civilian drivers.

These organizations under usual conditions of weather, work, on more or less satisfactory roads, can employ motor transportation with excellent results. On the continent, where the roads are admittedly better than in America, transport columns are composed entirely of motor ambulances, organized in groups of fifty, divided into three sections. The use of such means of transport has made possible the rapid evacuation of the enormous number of wounded, which would otherwise have encumbered the mobile organizations for days. To man this additional transportation, the bearer detachment is available either as attendants or drivers. Automboile transportation in this organization is more economical in personnel, as the chauffeurs themselves can be used as a loading detail and attendants, as they have no teams that require watching when halted. The transport column, when route conditions require extensive marches will establish rest stations en route, for the care, feeding, and treatment of the wounded en route, detaching a medical officer or a detail of enlisted men and equipment for this purpose.

The rest stations of a line of evacuation is on a by-road, and will be established at points at march intervals or less and will be arranged by use of buildings or other shelter for feeding and dressing

ordinary cases in transport and bed equipment for those cases that become untransportable. Arrangement must be made for rapid feeding at these points, and measures will ordinarily be taken to apprise the stations of the time of arrival of convoys of wounded. Should the route of evacuation be relatively extended and permanent, special parties will be sent up from the sanitary reserve of the line of communications to relieve the evacuation ambulance company personnel and equipment.

Transport columns and rest station parties of volunteer aid societies are extensively used abroad for this duty, and can be well used in our service particularly as a second echelon on long routes of evacuation. Where convenient, those columns and rest stations in the advance section should consist of the military sanitary service.

Embarkation stations are formed at the transport head, particularly at rail and water heads, for the reception, care, and loading, of the disabled; delivered by transport units, pending arrival of other means of transportation: these correspond in organization and equipment to rest stations, but must have greater bed, feeding, and shelter facilities. They may be formed of line of communications reserves or from aid societies personnel, with a military control. As they are relatively stationary and will have advantage of good shelter and accommodations near a fixed line of transportation, they can be manned by voluntary aid personnel to advantage. Their functions and duties are obvious.

Rest stations on railway and water transport lines will ordinarily not be required by hospital trains, as they will be equipped with ordinary necessities for feeding and caring for the sick. Trains and boats for paitents, however, will not be provided

with facilities for feeding the disabled; rest stations must be equipped with material and personnel for this purpose. They will be located on a siding or dock, where boats or trains can be stopped conveniently, and will have meals prepared in advance, through proper notification. In order to expedite movement, action can be taken, as in the German service, to load prepared meals and serving equipment on trains at the rest stations. The serving equipment to be brought back on the next trip.

More elaborate dressing and ward equipment will be provided at these points, than is had at the road stations. The personnel should consist of 2 medical officers, and some 15 or 20 cooks or attendants, arranged in day and night shifts.

The evacuation hospitals are allowed two to a division; personnel, 16 medical officers and 179 enlisted men; equipment of two field hospitals and divisible into sections. Evacuation hospitals have no transportation fixed, but will require some 16 wagons or trucks. Held well up on the lines of communications, they will be available for use at the front as soon as the conditions of the combat are determined. Their function is to provide more elaborate care for the wounded than can be given in the field hospitals, and they will be used primarily to clear the field hospitals, so that they can move forward with the command. As they have no transportation, they will, ordinarily, be kept on a water or rail transport line, packed for rapid movement.

In or after combat, these organizations may be established in whole or part, or by section at the lines of communication transport head, or near the field, or moved to the field and take over the wounded and field hospitals, by exchange of equipment. In the movement to the field, if no other transportation

is available, the evacuation ambulance company may be used as transportation.

The equipment of the evacuation hospitals permits use of tentage for shelter, but wherever possible, buildings of the locality will be taken. Here, more elaborate surgery can be done, as these hospitals may be fixed, if necessary, and reserve organizations sent up from the base of the general line of communications. Here, the definite sorting of patients will be made, and distribution according to probable length of disability be accomplished. The slightly wounded, sent to the convalescent camps, advance groups; those of moderate severity to the hospitals of the intermediate and base groups, infectious cases diverted to special hospitals, and the relatively permanently disabled sent to the base, en route to the service of the interior.

First Aid and Personal Hygiene

(Extracts from Soldier's Handbook)

AS MOST of the first-aid work in war under present conditions will be done by the individual soldier acting alone and not by a squad of two or more men, it is important that his training should be largely individual and such as will develop self-reliance and resourcefulness.

The object of any teaching upon first aid, or early assistance of the injured or sick, is not only to enable one person to help another but in some measure to help himself. The purpose of these directions is to show how this may be done by simple means and by simple methods. It is a mistake to think that you must know many things to be helpful, but you must understand a few things clearly in order to assist the patient in the severer cases until he can be seen by the surgeon or those who are thoroughly trained. In ordinary cases what you can do may often be all that is necessary.

These short instructions are intended for application anywhere—at a military post, in camp, or under any circumstances of ordinary life; but as the wounds received in battle are the most important to the soldier, it is the more necessary that he should know what to expect there, and what to do for himself and others. Most of these wounds are made by the rifle ball, fewer by shell or shrapnel, while those made by the saber and bayonet come last in frequency.

Wounds

When a ball enters or goes through the muscles or soft parts of the body alone, generally nothing need be done except to protect the wound or wounds

with contents of the first-aid packet, used as follows:

1. If there is one wound, carefully remove the paper from one of the two packages without unfolding compress or bandage and hold by grasping the outside folds between the thumb and fingers.

When ready to dress wound, open compress by pulling on the two side folds of bandage, being careful not to touch the inside of the compress with the fingers or anything else.

Still holding one roll of the bandage in each hand, apply the compress to the wound and wrap the ends of the bandage around the limb or part until near the ends, when the ends may be tied together or fastened with safety pins. The second compress and bandage may be applied over the first or may, if the arm is wounded, be used as a sling.

2. If there are two wounds opposite each other, use one compress opened out—but with the folded bandage on the back—for one wound, and hold it in place by bandage of the compress used to cover the other wound.

3. If there are two wounds, not opposite each other, apply a compress to each.

4. If the wound is too large to be covered by the compress, find and break the stitch holding the compress together, unfold it, and apply as directed above.

Be careful not to touch the wound with your fingers nor handle it in any way, for the dirt of your hands is harmful, and you must disturb a wound as little as possible. **NEVER WASH THE WOUND EXCEPT UNDER THE ORDERS OF A MEDICAL OFFICER.**

The bandaging will stop all ordinary bleeding. Generally this is all that is necessary for the first

treatment, and sometimes it is all that is needed for several days. The importance of the care with which this first dressing is made can not be too seriously insisted upon. It is better to leave a wound undressed than to dress it carelessly or ignorantly, so that the dressing must soon be removed.

Bandages and Slings

In addition to the slings made with the bandage, two forms of slings furnished by the ordinary clothing are shown.

Bleeding from Wounds

Now and then a wound will bleed very freely, because a large blood vessel has been wounded, and you must know how to stop the bleeding, or hemorrhage as it is called. Remember that all wounds bleed a little, but that as a rule this bleeding will stop in a few minutes if the patient is quiet, and that the firm pressure of the pads and bandage will keep it controlled. When bleeding is severe a feeling of faintness occurs and often the patient loses consciousness. This is due to the weakening of the action of the heart, so that a sufficient supply of blood does not reach the brain, and the bleeding usually stops when the pressure is thus diminished. The patient's head should be at once laid on a level with or lower than the body, and attention given rather to stopping the bleeding than a reviving the patient, who will usually soon recover consciousness if kept quiet with the head lowered after the bleeding is checked. A little stimulant, but not much, may be given under these circumstances. Occasionally, but not often, something else must be done.

Looking upon the heart as a pump, you will understand that to stop the current of blood pumped through the arteries you must press upon the blood vessel between the wound and the heart. This pressure stops the current of blood in the same way that you would stop the flow of water in a leaky rubber hose or tube by pressing upon it between the leak and the pump, or other source of power. The points or places where you can best do this for the different parts of the body are illustrated in the woodcuts. These points are chosen for pressure because the blood vessels which you wish to control there lie over a bone against which effective pressure can be made.

Points of Compression with Thumb and Fingers

The temporal artery is reached by pressure in front of the ear just above where the lower jaw can be felt working in its socket. A branch of this artery crosses the temple on a line from the upper border of the ear to above the eyebrow.

The carotid artery may be compressed by pressing the thumb or fingers deeply into the neck in front of the strongly marked muscle which reaches from behind the ear to the upper part of the breast-bone.

In bleeding from wounds of the shoulder or armpit the subclavian artery may be reached by pressing the thumb deeply into the hollow behind the middle of the collar bone.

In bleeding from any part of the arm or hand the brachial artery should be pressed outwards against the bone just behind the inner border of the larger muscle of the arm.

In bleeding from the thigh, leg, or foot, press backward with the thumbs on the femoral artery

at the middle of the fold of the groin where the artery passes over the bone and can be felt beating.

There are two other simple means for helping to stop bleeding—such as elevating or holding an arm or leg upright when those parts are wounded, and by applying cold to the wound; but you will find the compress and bandage, or the pressure made by your fingers, as described to be most useful in the great majority of cases.

When, however, the bleeding continues after you have used these simpler means, which they may do after 10 or 15 minutes, you will have to use what is called a "tourniquet," and generally will be obliged to improvise one out of material at hand.. The principle of such a tourniquet is easily understood —a pad or compress placed on the line of the artery and a strap or band to go over the pad and around the limb so that, when tightened, it will press the pad down upon the artery and interrupt the flow of the blood. In the arm apply the tourniquet over the point shown for compression by the fingers; in the thigh, 4 or 5 inches below the groin, as it can not be applied higher up.

The pad or compress may be made of such an object as a cork, or smooth round stone wrapped in some material, to make it less rough; the bandage folded, a handkerchief or a cravat being used for the strap. After tying the band closely around the limb any degree of pressure may be made by passing under it a stick, bayonet, or something of that kind, and twisting or turning it around so that the pad is pressed firmly in place. Turn the stick slowly and stop at once when the blood ceases to flow, fixing and stick in place with another bandage. Remember that you may do harm in two ways in using this rough tourniquet. First by bruising the

flesh and muscles if you use too much force, and, second, by keeping this pressure up too long and thus strangling the limb. It is a good rule to relax or ease up on this or any other tourniquet at the end of an hour, and allow it to remain loose but in place, if no bleeding appears. By watching you can tighten the tourniquet at any time if necessary.

Fractures

The next injury you must know how to help is a broken bone. The lower extremeties, thigh and leg, are more frequently wounded than the upper arm and forearm; and so you will find more fractures of the thigh and leg bones than of the arm and forearm. You will usually know when one of these long bones is broken by the way the arm or leg is held, for the wounded man loses power of control over the limb, and it is no longer firm and straight. What you must do is much the same in all cases—straighten the limb gently, pulling upon the end of it firmly, and quietly, when this is necessary, and fix or retain it in position by such splints or other material as you may have. This is called "setting" the bone. If you have none of the splint material supplied, many common materials will do for immediate and temporary use—a shingle or piece of board, a carbine boot, a scabbard, a tin gutter or rain spout cut and fitted to the limb, a bunch of twigs, etc. Whatever material you chose must be well padded upon the side next to the limb, and afterwards secured or bound firmly in place, care being taken never to place the bandage over the fracture, but always above and below.

Fracture of the arm: Apply two splints, one in front, the other behind, if the lower part of the bone is broken; or to the inner and outer sides if

the fracture is in the middle or upper part; support by sling. The inner splint should be short, not more than 7 or 8 inches long.

Fracture of the forearm: Place the forearm across the breast, thumb up, and apply a splint to the outer surface extending to the wrist, and to the inner surface extending to the tips of the fingers; support by sling.

Fracture of the thigh: Apply a long splint, reaching from the armpit to beyond the foot on the outside, and a short splint on the inside. The military rifle may be used as an outside splint, but its application needs care. A blanket rolled into two rolls, forming a trough for the limb, is useful.

The carbine boot may be used to advantage in splinting fracture of the thigh and leg.

Fracture of the leg: Apply two splints, one on the outside, the other on the inside of the limb. When nothing better can be had, support may be given by a roll of clothing and two sticks.

Many surgeons think that the method of fixing the wounded leg to its fellow, and of binding the arm of the body, is the best plan for the field, as the quickest and as serving the immediate purpose.

The object of all this is to prevent, as far as possible, any motion of the broken bone, and so limit the injury to the neighboring muscles, and to lessen the pain.

Be very careful always to handle a broken limb gently. Do not turn or twist it more than is necessary to get it straight, but secure it quickly and firmly in one of the ways shown, and so make the patient comfortable for carriage to the dressing station or hospital. Time is not to be wasted in complicated dressings.

Other Wounds

There are, of course, many wounds of the head, face, and of the body, but for the most part you will have little to do with these except to protect the wound itself with the contents of the first-aid packet, or, if bleeding makes it necessary, use in addition several of the packet compresses to control it. As the surface blood vessels of the head and face lie over the bones and close to them, it will generally not be difficult to stop the bleeding by this means or by the pressure with the fingers, as already shown. Remember, as you were told, to make the pressure between the heart and the bleeding point when the blood flows in jets or pulsations, showing that an artery is cut. When, however, the blood flows in a steady stream and is somewhat dark in color the wound is from a vein, and pressure should be made by a fairly tight dressing and bandage over the bleeding point, reenforced, if necessary, by pressure with the fingers over the bandage until the bleeding ceases.

With wounds about the body, the chest, and the abdomen you must not meddle, except to protect them, when possible without much handling, with the materials of the packet.

Cautions

You have already been warned to be gentle in the treatment of the wounded, and the necessity for not touching the wound must always be in your mind; but there are some other general directions which you will do well to remember.

1. Act quickly, but quietly.
2. Make the patient sit down or lie down.
3. See an injury clearly before treating it.

4. Do not remove more clothing than is necessary to examine the injury, and keep the patient warm with covering if needed. Always rip, or, if you can not rip, cut the clothing from the injured part, and pull nothing off.

5. Give alcoholic stimulants cautiously and slowly, and only when necessary. Hot drinks will often suffice when obtainable.

6. Keep from the patient all persons not actally needed to help him.

The Diagnosis Tag

The diagnosis tag is very important in preventing unnecessary handling of the wounded man and interference with his dressing on the field. When available, it is to be attached by the person who applies the first dressing and is not to be removed until the patient reaches the field hospital. When a patient has a tag on, it is to be carefully read before additional treatment is given, and will usually indicate that no further treatment is needed before reaching the hospital.

Other Accidents and Injuries

There are a few other conditions about which you should be informed, although they are not peculiar to military life, the first two only being related to wounds.

Poisoned Wounds

When a wound is known to be poisoned, such as one infected by the venom of a snake or a rabid animal, the treatment should be directed toward preventing the passage of the poison into the circulation. In snake bites the poison acts quickly;

to prevent its absorption a bandage should be carried around the limb between the wound and the heart, tight enough to compress the veins; then get the poison out of the wound by laying it open and sucking the poison out (if there is no crack in the mouth or ips) and destroying what is left by cauterization with fire or caustic. Stimulants may be freely given if the heart is weak. Care should be taken, however, not to poison the patient with overdoses of whisky or other stimulant, as has been frequently done, especially in the case of children. Do not give over half a pint of whisky to a grown person inside of four hours, and proportionately less for children, divided into four doses.

In the bite of a rabid animal the poison is for a long time localized in the wound and there is no danger of immediate absorption. Do not use a tourniquet, but use the other local measures advised for snake bite.

Shock

By this term is meant a very severe physical and mental depression following extensive wounds, such as those produced by shell, and ordinary wounds in which the chest and abdomen are entered. You can hardly mistake this condition, for it resembles approaching death. If possible, the patient should not be moved, but kept still, lying down with the head low, warmed, and carefully stimulated. This will be difficult, perhaps impossible, on the battle field, but it should be attemped unless removal is unavoidable.

Fainting

This condition is generally the result of severe bleeding, or exhaustion from fatigue. The patient

should be laid upon his back, head lowered, arms by the side, feet extended, and should be carefully stimulated. This condition is rarely dangerous.

Poisoning

Poisoning by way of the stomach may result from swallowing mineral or vegetable poisons. In the military service it often follows the taking of food which has undergone changes resulting in the production of poisons—ptomaines, etc.

Whenever there is no evidence of caustic action, such as burns on the mouth, an effort should be made to empty the stomach and bowels by the free use of emetics and laxatives, such as mustard and warm water, two teaspoonfuls; a tablespoonful of salt in a glass of warm water; epsom or rochelle salts; castor oil, etc. After the poison has been evacuated, give stimulants and apply heat and rubbing externally.

When the lips are burned, give no emetic; give olive oil, cottonseed oil, or castor oil, internally, and also the proper antidote if you know it.

Drowning

Being under water for four or five minutes is generally fatal, but an effort to revive the apparently drowned should always be made unless it is known that the body has been under water for a very long time. The attempt to revive the patient should not be delayed for the purpose of removing his clothes or placing him in the ambulance. Begin the procedure as soon as he is out of the water, on the shore or in the boat. The first and most important thing is to start artificial respiration without delay.

The Schaefer method is preferred because it can be carried out by one person without assistance, and

because its procedure is not exhausting to the operator, thus permitting him, if required, to continue it for one or two hours. Where it is known that a person has been under water for but a few minutes, continue the artificial respiration for at least one and a half to two hours before considering the case hopeless. Once the patient has begun to breathe, watch carefully to see that he does not stop again. Should the breathing be very faint, or should he stop breathing, assist him again with artificial respiration. After he starts breathing do not lift him, nor permit him to stand until the breathing has become full and regular.

As soon as the patient is removed from the water, turn him face to the ground, clasp your hands under his waist and raise the body so any water may drain out of the air passages while the head remains low.

Schaefer Method

The patient is laid on his stomach, arms extended from his body beyond his head, face turned to one side so that the mouth and nose do not touch the ground. This position causes the tongue to fall forward of its own weight and so prevents its falling back into the air passages. Turning the head to one side prevents the face coming into contact with mud or water during the operation. This position also facilitates the removal from the mouth of foreign bodies such as tobacco, chewing gum, false teeth, etc., and favors the expulsion of mucus, blood, vomitus, serum, or any liquid that may be in the aid passages.

The operator kneels, straddles one or both of the patient's thighs, and faces his head. Locating the lowest rib, the operator, with his thumbs near-

ly parallel to his fingers, places his spread hands so that the little finger curls over the twelfth rib. If the hands are on the pelvic bones the object of the work is defeated; hence the bones of the pelvis are first located in order to avoid them. The hand must be free from the pelvis and resting on the lowest rib. By operating on the bare back it is easier to locate the lower ribs and avoid the pelvis. The nearer the ends of the ribs the hands are placed without sliding off, the better. The hands are thus removed from the spine, the fingers being nearly out of sight.

The fingers help some, but the chief pressure is exerted by the heels (thenar and hypothenar eminences) of the hands, with the weight coming from the shoulders. It is a waste of energy to bend the arms at the elbows and shove in from the sides, because the muscles of the back are stronger than the muscles of the arms.

The operator's arms are held straight, and his weight is brought from his shoulders by bringing his body and shoulders forward. This weight is gradually increased until at the end of the three seconds of vertical pressure upon the lower ribs of the patient the force is felt to be heavy enough to compress the parts; then the weight is suddenly removed; if there is danger of not returning the hands to the right position again they can remain lightly in place, but it is usually better to remove the hands entirely. If the operator is light, and the patient an over-weight adult, he can utilize over 80 per cent of his weight by raising his knees from the ground, and supporting himself entirely on his toes and the heels of his hands, the latter properly placed on the ends of the floating ribs of the patient In this manner he can work as effectively as a heavy man.

A light feather, or a piece of absorbent cotton drawn out thin and held near the nose by some one, will indicate by its movements whether or not there is a current of air going and coming with each forced expiration and spontaneous inspiration.

The natural rate of breathing is 12 to 15 times per minute. The rate of operation should not exceed this; the lungs must be thoroughly emptied by three seconds of pressure, then refilling takes care of itself. Pressure and release of pressure, one complete respiration, occupies about five seconds. If the operator is alone he can be guided in each act by his own deep, regular respiration, or by counting, or by his watch lying by his side. If comrades are present, he can be advised by them.

The duration of the efforts at artifi,cial respiration should ordinarily exceed an hour; indefintely longer if there are any evidences of returning animation, by way of breathing, speaking, or movements. There are liable to be evidences of life within 25 minutes in patients who will recover from electric shock, but where there is doubt, the patient should have the benefit of the doubt. In drowning, especially, recoveries are on record after two hours or more of unconsciousness; hence, the Schaefer method, being easy of operation, is more likely to be persisted in.

Aromatic spirits of ammonia may be poured on a handkerchief and held continuously within 3 inches of the face and nose; if other ammonia preparations are used, they should be diluted or held farther away. Try it on your own nose first.

When the operator is a heavy man it is necessary to caution him not to bring force too violently upon the ribs, as one of them might be broken.

Do not attempt to give liquids of any kind to the patient while unconscious. Apply warm blankets and hot water bottles as soon as they can be obtained.

The Schaefer method of artificial respiration is also applicable in cases of electric shock, asphyxiation by gas, and of failure or respiration following concussion of the brain.

First-Aid Rules

1. Never touch a wound with anything unclean —dirty fingers, nondisinfected bandages, dirty water, etc.; it may cause inflammation, ulceration, or blood poisoning.

2. Expose the wound by removing the covering article of dress, which contains many impurities. Unbutton or cut clothes and examine extent of bleeding. Open all articles of clothing which might hinder circulation of blood or breathing (collar, necktie, belt). To avoid pain and bleeding, raise legs by putting under them a blanket roll, saddle, truss of straw, etc.; slight bleeding will often cease in this position of its own accord, without bandaging. A bandage is advisable to protect the wound from dirt, flies, or cold. Use the first-aid packet. (Coats, pouches, haversacks, etc., may be used as pillows.

3. If the wound does not bleed at all or only a few drops at a time, no constriction or pressure is necessary.

4. If the blood is spurting in a strong stream from a wound, you must use measures to stop it.

5. Whoever is able to walk after being wounded must repair at once to the dressing station. Those who can not walk must be carried by stretcher bearers and must await their arrival by lying down as quietly and as comfortably as possible in order to avoid pain, bleeding, and aggravation of the wound.

Sunstroke

Sunstroke or heat stroke occurs in persons exposed to high temperature either in or out of the sun. The face is flushed, skin hot and dry, breathing labored, pulse rapid, heat of body great. The patient may be unconscious. Place him in the shade, remove outer clothing, wet the undershirt, and try to lessen heat of body by cold applications to the head and surface generally. Give water to patient to drink as soon as he is able to swallow.

The heat may also cause, especially when soldier is much fatigued, a form of exhaustion without insensibility. Rest on the back in the shade with cold applications to the head and a little aromatic spirits of ammonia are usually sufficient to relieve.

In rare cases this exhaustion may go on to threatened collapse, with cold skin and extremities, pale face, and very weak pulse. Here alcoholic stimulants and heat to the body become necessary.

It is well to be warned that both sunstroke and heat exhaustion are common and severe among drinkers and the intemperate.

Burns

Do not pull the clothing from the burnt part, but rip or cut it off. Do not break the blisters, or prick them even if large. Protect a burn quickly with a mixture of equal parts of linseed or olive oil and limewater, if you have them; or with the plain oil, covering the whole with lint or cotton wool. Put nothing on a burn that will be difficult to remove afterwards.

Freezing and Frostbite

The part frozen, which looks white, or bluish white, and is cold, should be very slowly raised in

temperature by brisk but careful rubbing, in a cool place and never near a fire. Stimulants are to be given cautiously when the patient can swallow, and followed by small amounts of warm liquid nourishment. The object is to restore the circulation of the blood and the natural warmth gradually and not violently. Care and patience are necessary to do this.

Transportation

The carriage of patients, for moderate distances on or from the field, is best done with the service litter, and when that can not be procured, by some improvised substitute which secures the comfort and safety of the person disabled. These methods, and those by one or more bearers, are fully described in the Drill Regulations for the Hospitals Corps, and are not repeated here.

It will generally be found necessary during or after an action to restrict the number of bearers to two, and attention to methods requiring not more than two bearers is recommended.

Take care of Your Health

1. In times of peace and freedom from deadly infectious diseases about 4 men out of every regiment of 1,000 men die of disease in a year. In time of war this number is greatly increased on account of unavoidable exposures and privations. A little knowledge and a little care on the part of each soldier will often prevent him from becoming sick, and will increase the efficiency of the command to which he belongs. Knowledge alone is of no use unless care is taken to apply it practically.

2. A soldier should care for his teeth because their damage or loss will result in improper chewing of food and thus in various diseases of the digestive system. Decay, which is the commonest disease of the teeth, is caused by allowing particles of food to remain on and between them. These should be removed by thorough brushing. It is well to use a good tooth powder once or twice daily, In order that decay of the teeth may be detected before serious damage has occurred, a dental surgeon should be consulted at frequent intervals. Toothache indicates that the deeper parts of the teeth have become diseased and a soldier should not, therefore, wait until the teeth ache to consult a dentist, as by that time destruction may be so great as to much increase the severity of the dental operations needed or even to make impossible any effective repair.

3. A soldier should endeavor to be always at his best. He should avoid all exposures, not in line of duty, which he knows would be likely to injure his health, for if he is from any cause below par he is liable to break down under influences which otherwise might have had but little effect on him.

4. Even in garrison, in time of peace, soldiers often expose themselves unnecessarily by going out without overcoats when the weather is such as to require their use, or by failing to remove damp socks or other clothing on their return to barracks.

5. Before starting on a campaign the soldier should provide himself with the necessaries for personal cleanliness and for keeping his clothing in repair; towel, soap, toothbrush, a few strong safety pins, and spare buttons. His shoes and socks should be carefully selected to fit, and it is well to have shoes broken in by a few days' usage before starting.

6. At rests on the march he should sit down or

lie down if the ground is suitable, for every minute so spent refreshes more than five minutes standing or loitering about.

7. At the midday rest lunch should be eaten, but it should always be a light meal.

8. On the march or during exercise in hot weather the body loses water continuously by the skin and lungs, and this loss must be replaced as it occurs to keep the blood in proper condition. Free evaporation of water from the skin is necessary to keep the body at its natural temperature and prevent heat prostration. Therefore, not only must water be supplied as needed, but the clothing should be open, when permitted, to assist the evaporation. Only a few swallows should be taken at a time, no matter how plentiful the water supply may be. When exceeding thirsty, after a long stretch, water should not be taken freely at once but in smaller drinks at intervals, until the desire for more is removed. Very little water should be taken during the first two hours of the march, but after the seventh mile in hot, oppressive weather a canteenful will be needed for each 6 or 7 miles march. If the soldier starts with a full canteen it should last him, therefore, for an ordinary march of 14 miles.

9. Smoking in the heat of the day or on the march is depressing and increases thirst.

10. On hot marches water should be taken quite frequently, but, as already stated, in small quantities at a time, to replace the loss by perspiration. This will often prevent attacks of heat exhaustion and sunstroke.

11. On a hurried or forced march, particularly in sultry weather, a soldier may become faint and giddy from the heat and fatigue. His face becomes pale, his lips lead-colored, his skin covered with

clammy perspiration, and he trembles all over. His arms and equipments should be removed and his clothing opened at the neck, while he is helped to the nearest shade to lie down, with his head low, until the ambulance train or wagons come up. Meanwhile, fan him, moisten his forehead and face with water, and, if conscious, make him swallow a few sips from time to time.

12. In sunstroke the man is unconscious and often has convulsions. He should be cared for as stated in paragraph 11, using cold water freely on the head, face, and body, until the arrival of the surgeon.

13. Military operations often have to be conducted without regard to temperature, but in hot weather unnecessary exposure to the sun should be avoided.

14. When camp is reached and the tents pitched, each tent should be trenched to keep out the rainfall, even although rain seems unlikely. Each man should then prepare the floor for his bed by picking out hard irregularities and scooping out a shallow depression for the hip bones. Grass, hay, leaves, or other available material should be laid on as a mattress, with the rubber poncho or slicker over all to keep dampness from the body. In good weather blankets should be unrolled and spread out to air before the time for their use.

15. If the soldier comes into camp much exhausted a cup of hot coffee is the best restorative. When greatly fatigued it is dangerous to eat heartily.

16. When the tents have been arranged for the night and the duties of the day are practically over, the soldier should clean himself and his clothes as thoroughly as the means at hand will permit. No opportunity of taking a bath or of washing socks and

underclothing should be lost. In any event the feet should be bathed or mopped with a wet towel every evening to invigorate the skin.

17. In the continued absence of opportunity for bathing it is well to take an air bath and a moist or dry rub before getting into fresh underclothes and, in this case, the soiled clothes should be freely exposed to the sun and air when the blanket roll is unpacked.

18. By attention to cleanliness of the person and of the clothing the discomforts of prickly heat, chafing, cracking, blistering, and other irritations of the skin will be avoided. If chafings do occur apply to the surgeon for a healing remedy, for, if neglected, they may fester and cause much trouble.

19. A hearty meal should be eaten when the day's work is over, but the soldier should eat slowly, chewing every mouthful into a smooth pulp before swallowing; and it is good when one can rest a while after this meal. Hard bread and beans when not thoroughly chewed give rise to diarrhea, one of the most dangerous of camp diseases. Fresh meat should be eaten sparingly when used for the first time after some days on salt rations.

20. The soldier would do well to restrict himself to the company dietary. Particularly should he avoid the articles of food or drink for sale by hawkers and peddlers. Green fruit and overripe fruit are dangerous, as is also fruit to which the individual is unaccustomed. Unpeeled fruit should never be eaten, for it may have been handled by persons suffering from dangerous infectious diseases.

21. It should be unnecessary to speak of the danger from the use of intoxicating liquors, for every soldier knows something of this. The mind of a man under the influence of these liquors is so

befogged that his is unable to protect himself from accidents and exposures. How many men have been passed from this world because of exposures during intoxication! How many have lost their health and strength and become wretched sufferers during the remainder of a shortened existence! Besides, for days after indulgence in liquor the system is broken down and the individual less able to stand the fatigues, exposures, or wounds of the campaign.

22. If filtered or condensed water is not furnished to the troops, and spring water is not to be had, each soldier should fill his canteen overnight with weak coffee or tea for the next day's march. This involves boiling, and the boiling destroys all dangerous substances in the water. Typhoid fever, cholera, and dysentery are caused by impure water.

23. All the belongings of the soldier should be taken under shelter at night to protect them from rain or heavy dews.

24. When not prevented by the military conditions, soldiers should sleep in their shirts and drawers, removing their shoes, socks, and other clothing.

25. In the morning, wash the head, face, and neck with cold water. With the hair kept closely cut this can be done even when the water supply is limited.

26. In hot climates, where marches are made or other military work performed in the early morning or late in the evening, a sleep should be taken after the midday meal to make up for the shortened rest at night. Everyone to keep in good condition should have a total of 8 hours sleep in the 24.

27. If the march is not to be resumed, the soldier should take the first opportunity of improving his sleeping accommodations by building a bunk, raised a foot and a half or more from the ground.

This is of the first importance when the ground is damp. The poncho, or slicker, must be relied upon as a protection in marching camps, but when the camp is to be occupied for some days bunks should be built.

28. Malaria and yellow fever are caused by the bite of certain varieties of mosquitoes which have at sometime before bitten a person having one of these diseases. They do not usually bite while the sun is above the horizon. To avoid malaria do not sleep in or near the houses of natives of malarious regions, and if possible protect the body during sleep with a mosquito net, which should be carefully tucked in so that it will not touch the bare skin of any portion of the body. If nets are not available, smear the uncovered skin with kerosene or some oil having a strong odor, such as citronella or peppermint.

29. When malarial fevers are prevalent, avoid chilling the body by sleeping on damp ground by building a bunk, and in the morning take hot coffee immediately after roll call. Men doing duty at night should, if practicable, have a lunch and some coffee before starting.

30. The soldier should never attempt to dose himself with medicine. He should take no drugs except such as are prescribed by the surgeon..

31. No matter how short a time the camp is to be occupied, its surface should not be defiled. The sinks should be used by every man, and the regulations concerning their use should be strictly complied with. Waste water and refuse of food should be deposited in pits or other receptacles designed to receive them. Attention to these points will prevent foul odors and flies.

32. When there are foul odors and flies in a camp, the spread of typhoid fever, cholera, dysentery, and yellow fever is likely to occur.

33. When any of these diseases are present in a command, every care should be taken to have the hands freshly washed at meal times.

34. In the camps of field service the interior of tents should be sunned and aired daily, and efforts should be made by every soldier to have his bunk, arms, equipments, and clothing in as neat and clean condition as if he were in barracks at a permanent station.

35. Harmful exposures are more frequent in hot than in cold weather. Soldiers seek protection against cold, but in seeking shade, coolness, and fresh breezes inhot weather they often expose themselves to danger from diarrhea,, dysentery, pneumonia, rheumatism, and other diseases. A chill is an exciting cause of these affections; it should be avoided as much as possible.

36. When the feet become wet the first opportunity should be taken of putting on dry socks.

37. When the clothing becomes wet in crossing streams or in rainstorms there is little danger so long as active exercise is kept up, but there is great danger if one rests in the wet clothing.

38. When the underclothes are wet with perspiration the danger is from chill after the exercise which caused the perspiration is ended. If the soldier can not give himself a towel rub and a change of underclothing, he should put on his blouse and move about until his skin and clothes become dry.

39. To rest or cool off, and particularly to fall asleep, in a cool, shady place in damp clothes is to invite suffering, perhaps permanent disability or death.

40. When an infectious disease is known to be present among the civil population in the neighborhood of a military camp or station, care should be taken by every member of the command to avoid exposure to the infection. Protection from smallpox and typhoid fever can be obtained by timely vaccinations against these diseases, repeated when neccessary. Scarlet fever, measles, and diphtheria are met with in the United States, but in some localities our troops may have to guard against smallpox, yellow fever, cholera, and bubonic plague. The careless or reckless individual will be the first to suffer, but he may not suffer alone; many of his comrades may become affected and die through his fault.

41. Such infections prevail mostly among the lower classes of a community who have no knowledge of the difference between healthful and unhealthful conditions of life. Association with them and the use of their dwellings, especially for sleeping purposes, should be avoided.

42. The most serious risk to which the health of young men is exposed both in military and civil life is one of their own making, that of venereal diseases contracted by association with lewd women. There are three of these diseases—syphilis or pox, gonorrhea or clap, and chancroid or soft chancre, of which the first two are the more serious. Syphilis is a blood disease which begins as a small hard sore and may affect any part or organ of the body. Sores in the mouth are very common in this disease and render anything with which the lips come in contact dangerous, as is contact with a sore in any other part of the body. Therefore, persons with syphilis should not allow others to use their drinking cups, spoons, forks, pipes, towels, etc.

Gonorrhea is an infection of the lining of the penis and causes a burning when passing water, and a white discharge. It is the cause of stricture, inflammation of the bladder, and other serious troubles, and is very hard to cure completely. The discharge is often a cause of blindness, if by unclean hands it is carried to the eyes. A soldier who becomes infected with these diseases should be very careful to keep his hands and person very clean and should promptly consult an Army surgeon and carefully follow his advice, both for his own sake and that of his companions. The advice and treatment of friends who are not physicians and of quacks should never be taken. The great majority of prostitutes and other women of immoral life become infected sooner or later with one or both of these diseases, and give them to men who have intercourse with them. The only sure way to avoid danger of getting these diseases is to live a clean and moral life. It is stated by medical authorities that sexual intercourse is not necessary to preserve health and manly vigor, and the natural sexual impulse can be kept under control by avoiding associations, conversations, and thought of a lewd character. Persons who will nt exercise self-control in this matter can greatly lessen the risks of indulgence by intelligence and a care in the practice of personal cleanliness and the prompt use of the means of venereal prophylaxis prescribed by Army order for those who have exposed themselves. Men who immediately after intercourse urinate and wash the private parts thoroughly with soap and water will usually escape disease as will those who use the covering called the condom. Drunkenness greatly increases the risk of infection.

43. Every soldier should become familiar with the instructions in the "First Aid and Personal Hygiene," so as to be able to help himself or others in the event of wounds or accidents.

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